SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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The Royal School of Mines, Jermyn Street.

Mr. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

Lecture XXXVI.—From what we have already said (remarked Mr. Smyth) it will have been seen that a proper selection of modes of working will often make all the difference between two mines, similarly situated, as to the profit to be derived, and the degree of safety which the men may enjoy. Although the modes of working referred to may be applicable when the lodes present no great regularity, stoping is most favourable when the whole of the vein has to be removed. It is, therefore, a system very generally adopted, but there are one or two variations, which require special notice. These variations are generally attributable to the nature of the circumstances to be dealt with. Thus, in the silver mines of the Hartz the underhand system is more generally prevalent than in Saxony or Cornwall; and that not only on account of the material worked, but because the lodes occur between stratified deposits, and the courses of ore run along them in a horizontal form. In the latter case the level is driven so as to cut the vein in a productive part, having the ore-bearing ground in close proximity, so that a rise of a few feet will bring the miners into it. Separate sets of men work in the separate headings which are thus formed, and by overhand stoping cut away the orey material. Those lodes are often extremely soft, so that, although only 6 or 8 feet in width, the whole cannot be opened out at once. Thus, in a Spanish mine, at Linares (of which a diagram was exhibited), an opening is made in the centre near the top, and two others at the sides below, and strong timbering is required. It is always, however, advisable when possible to work the whole breadth together, as that is much cheaper than to get it by narrow workings; but when this is attempted, under such circumstances, the character of the rock must be carefully watched from fathom to fathom, to see how far it may be justifiable to expose the men to the dangers arising from the fall of large masses, which are liable to break away when the opening below becomes large. In even moderate sized lodes, as at the East Wheal Rose, which is 5 ft. 6 in. wide, it is sometimes impossible to make the opening the full width of the lode, which is in a running ground, and much timber has to be put in. In cases of this kind a system of arching at intervals is sometimes adopted with success, when timbering cannot be brought in with equal advantage. Thus, in the county of Wicklow, where beds of iron pyrites occur 18 to 24 feet in width, this system is carried out to a great extent. Again, it sometimes happens that masses of the lode are left here and there between the walls to keep them asunder. Sooner or later these natural props are taken away, for the sake of the ore they contain; and if this is done incautiously the result is that great cracks, reaching up to the surface, are caused, and much damage is sometimes done in this way to the buildings or works above ground.

It is important, however, to look at cases in which exceptionally wide lodes have been worked by other methods. If we take some of the Cornish veins, when parallel branches or strings of tin ore occur, making a width altogether of 16 or 18 feet, we shall probably find the ore is small in quantity, compared with the mass of material with which it is associated. The first thing to be done is to permanently secure the levels, and then, having sunk a winze, we shall begin at the bottom level a series of stopes, which reach to the level above, putting in stull pieces of sufficient strength. The ore is then picked out, and the rubbish, or attle, carefully arranged to fill up the vacancies made. Then, having effected this on one side of the lode, if appearances are similarly good on the other side, openings of a like character may be made, and the same process repeated. This principle of taking out the material in stages and by piecemeal, as it were, and working across, is a very important one, not only in metalliferous mines but in others. The great question, however, is when so large a proportion is taken out whether it will not be necessary to introduce, from the outside, other material for filling up the vacant spaces. This may be sometimes done with great advantage, and where large deposits have to be dealt with it is a question which will have to be faced. Again, it is a point to consider whether it may not be better to sink several stages one after another, or whether we should go down to a certain depth, drive out a new level, and begin a fresh series of stages. Ordinarily, when the mineral to be worked is uncertain as to quantity, a prudent manager will prefer the latter course. At the Foxdale Mine, in the Isle of Man, in the 90 fm. level the lode is 40 feet in width, and so very soft that only part can be removed at a time. They, therefore, drive the level in the richest part of the lode, with cross-cuts now and then to either side, when, if appearances are favourable, levels may be run, and the intermediate space got bit by bit. It would be impossible in metalliferous mines to do more than this, except keeping the works so advanced that when one part is exhausted there would be further ground explored and ready to come into play. Take another case, that of the curious hematite mines at Ulverston, where it is uncertain how far the metallic mass reaches down, since it has been explored to the depth of 100 fathoms and the bottom has not yet been reached. It is impossible to expect that a manager would expend thousands upon thousands of pounds in sinking to the bottom before he begins to get the mineral; accordingly, they sink only so far as to enable them to begin a succession of stages. The system they adopted was this:—The shaft was sunk in the solid ground, near the side of this immense mass of metalliferous material, the upper portion being clays, sands, gravels, and other alluvial deposits, and then limestone. This shaft is intended to be permanent, and thus is properly lined and secured. As soon as a sufficient depth was reached a cross-cut was driven out away from the limestone into the iron ore, a distance of 150 feet, without coming to firm ground again. The drift was well timbered. If the ground had been worked as usual, spilling would probably have to be resorted to, but at the present time, for the purpose of obviating this as much as possible, the cross-cuts are driven at intervals. Occasionally they come upon great lumps or detached masses of limestone, &c., and as it would be a waste of time to cut through them, the level is curved, to avoid the obstruction. From the level a rise, called a "cock-loft," is made, and the ore worked out in three stages, one above another, the uppermost first, the middlemost secondly, and then the undermost. The shaft is then sunk lower, and another section worked through in the same way. This system saves great sums in timbering and narrow working, but it has some dangers peculiarly its own. When quicksands or other running ground are overhead, they sometimes, despite of all precautions, break through, and rush into the workings in such quantities and with such force that the timber is destroyed and the shaft filled up to a considerable height.

These vast irregular deposits wherever they occur, whether in England or abroad, will always have to be dealt with according to the peculiar geological circumstances of each. Thus, at Rammelsberg, where the deposits are irregular, the works are often very broad, but the ground is very hard, and fire-setting has to be resorted to, a process I have already described as one requiring great caution and skill in managing the air-channels. The level is carried in with elliptical arching, whilst above the arch the attle is built up around them, and even material is brought from the surface, so as to enable the men to stack their fires under favourable circumstances.

Another example is offered by the silver mines of Almaden, in Spain, where the works are carried on upon a scale of regal magnificence, and upon a system calculated to secure the permanence of the mines in a remarkable degree. The lode is from 50 to 60 feet thick; and two levels are carried through it, one above the other, at about its middle, with occasional cross-cuts. The working is from below upwards, and upon a most economical principle. The quantity taken out at once is about 4 varas in width, a vara being between 2 and 3 feet English. Arches of stone are then built in, forming a foundation for what is to come. A number of winzes are next sunk, and then the whole orey material is got out, its place being filled with stone walling, and intermediate empty spaces secured, so as to ensure perfect safety. Another remarkable instance of this method of working any large deposits may be quoted, as showing that however the general practice of one country differs from another, they will follow very different plans of working under precisely similar circumstances, and bring about the same results. Indeed, a great waste of time and money might often be avoided if men would not set about working these great repositaries without knowing what has been done elsewhere. Some time ago I visited some extensive iron mines in Bavaria, in which this system is carried out—namely, at Arztoy, near Wrinnedel, which I do not remember to have seen described in any book. The lode is between 60 and 70 feet in width, and may be fairly called a contact-lode, between two kinds of rock, of a very soft nature, requiring only pick-work, but in which especial care must be taken. I may mention in passing that ground of this kind is sometimes very deceptive. It is hard at first, and may sometimes even require blasting, but it will not stand for any length of time when opened out. This is particularly the case with some of the hematite iron ores, the laminated structure of which goes rapidly to pieces. Again, in the Hartz mines the ore is extracted by means of transverse cuttings. The Spitaler lode, at Schemnitz, in Hungary, which is from 50 to 60 feet wide, is worked on the same principle, by carrying a drift across from wall to wall. The intermediate masses are then extracted in three alternate portions. The middle one is taken first, and the space being filled in with stone, the other portions are won.

Lecture XXXVII.—In working out these large deposits, or lodes, it must be obvious that there will be a constant risk, not only to the lives of the men, but of the loss of a large portion of the valuable mineral, by the breaking down of levels, through insufficiency of support, and the consequent abandonment, probably, of that part of the lode. It is incumbent, therefore, upon every prudent manager not only to make choice of a good plan, but to take care that it is properly carried out. No contrivance, however, will, in most of these cases, give perfect security to the men, if they advance too far beyond the timbering towards the place where they are at work—that is to say, they must be protected close up to their work. In some few cases a peculiar sort of work is adopted, in the broken ground which the German miners know under the term of "Bruckbau," and which they sometimes drive into out of the solid ground, finding, as it were, an accumulation of a natural kind of loose attle. In these cases it may be impossible to proceed without strong spilling laths being put in, and the greatest care taken. In advancing, too, into ancient workings the attle left, perhaps, hundreds of years ago by the old men may be found worth the smelting. Thus, in Saxony there are mines in which the greater portion of the tin obtained is got from debris of this kind. I have seen places where the men are armed with a stout pole, 10 to 12 feet long, shod with iron. They then advance beyond the timbering, and by prodding at the mass before them they dislodge an overhanging block, vast quantities come down with a run, and the men have to flee for their lives to little niches of refuge, which they make in case they are not able to reach the main timbering. I am in the habit of visiting a mine in Cornwall where this sort of run comes on sometimes to a great extent; and in some places the only way of getting the mineral is by removing the fallen material, and so letting more come down. Thus, I have known cases where they have not advanced a foot for two or three years, and yet have sent up to the surface a very large quantity of orey material. When much ore occurs together, as at Monte Catini, where deposits of rich ores of copper, 30 and 40 feet in width, are found, in the midst of masses of softened serpentine, it is necessary to make cross-cuts, and when one portion is worked out to fill in the space thus made with attle before opening another.

These are some of the modes of working large lodes; and we shall see in dealing with stratified deposits that systems of a similar kind are introduced when the mineral deposits are inclined at a considerable angle, and any large portion of the mineral has to be left behind. Thus, colliery workers and metalliferous miners may take useful lessons from each other. I have already laid it down as an essential preliminary that in settling the method of working a stratified deposit reference must be had to the amount of get, various surface considerations, and the mode of ventilation intended to be carried out; but I must also point out that a manager should be acquainted with the methods practiced in different districts, or otherwise he may adopt plans by which there will be a great loss of mineral, and great danger to the lives of the workmen throughout the whole existence of the mine, and a continual source of anxiety and danger if waste places and goafs are left too near the shafts. In dealing with stratified deposits, you may ordinarily sink vertically, and intersect the workable seam at a certain distance from the surface. In the Forest of Dean, as in other districts, there are many seams at no great depth, but whether it is best to go at once to the bottom or begin sooner depends upon local circumstances. It is a question which often arises whether the quality of such and such a seam is of a degree which will best suit the trade of the neighbourhood, and so be the best to commence on. In one and the same field coal of different qualities and thickness may occur, in which cases we must be guided by special circumstances which should be opened first. In other cases it may be desirable, in order to supply the wants of a large trade, to open two or more seams at the same time. If steam coal will command a good trade we may reserve the softer coals nearer the surface, and work out the deeper seams. In beginning the work we must, in the first place, remember that immediately around the shaft there will by every prudent manager be left untouched a certain area for the shaft pillar; and according to the depth at which the coal is worked, and the length of time you have to work it, that pillar will be of smaller or larger dimensions, but those dimensions must be settled at once. This is a most important point, as the shaft pillar has to support all the weight not only of the shaft but of the machinery at the surface. In small and shallow mines this is often considered of not much importance; but very serious results sometimes occur from the settlement which follows throwing all the machinery out of gear. Indeed, weakening to a very small extent the pillars will move the ground, and disturb the horizontality of the bearings, and the principal axis has sometimes been broken, the machinery greatly injured, and the lives of all in the pit placed in jeopardy.

Again, there is another danger arising from want of proper plans at first, which will be very clearly seen when we look at the next process—working away from the shaft bottom. If the drifts are too large, or the distance between them too small, it will be found after a few years impossible to maintain them as permanent thoroughfares, and ruinous results may follow. "Thrust and creep" may set in, by which whole districts of coal fields have been endangered or entirely lost. This is a matter of the greatest interest and importance, and much information may be gleaned from the evidence given before various parliamentary committees and commissions; and particularly from that of the late Mr. Buddle. If we get a strong thrust, acting downwards from the weight of the measures above, the first effect will be a break down of the roofs of the levels, which will have to be met by strong timbering. If the sides and roof are tolerably strong, the effect will be to press down the pillars and sides, as it were, into the ground below, and force up the floor of the level, which will involve the constant attention of the nightmen or roadmen, as they are called, who will have to cut away the rising material, and so keep the bottom of the level even. When a creep of this kind sets in it frequently extends over a large area, travelling from one mine to another, until whole districts of workings are lost. In this way hundreds of acres in the Durham coal fields have been destroyed. The relative size of the openings and pillars is, therefore, a matter of vital importance, and in laying out our plans, we must make the pillars of such a size as to prevent "creep," or if it should occur, to enable us to deal with it successfully. If we are not careful in this matter we may fall into the very mistakes which were common three-quarters of a century ago, and which were attended with such disastrous results. Another source of danger I have already named, that of having large spaces of goaf near the pillar-shafts, which get filled either with carbonic acid gas or fire-damp, and are continual and constant sources of danger, as in the latter case the incautious use of a naked light may produce an explosion which would endanger the safety of the shaft, and, perhaps, bury all below in a living grave.

The extraction of the stratified beds or seams of coal and iron ore is a subject of much variety. When the whole of a bed is sought to be extracted it will often be found, even in good seams, that there is a good deal to be left behind. Sometimes there may be what the miners call "dirty coal;" or bands of clay-slate or other material may occur—and thus the method of working may have to be modified a good deal to meet circumstances of this kind. We must remember in dealing with some of the stratified beds other than coal, such as building-stone, a good deal depends on getting large sizes, or slabs; and so in a colliery it is a great thing to obtain as much round coal as possible, and to make as little slack. The relative proportion of round coal and slack varies very much, but the importance of making as little small as possible is obvious, when the value of one at the surface is only 2s. or 3s. a ton, while the other may be 8s. or 10s. The mode of working to be adopted should, therefore, be devised so as to get as large a proportion of round coal as possible. This is a point which is very little considered or known beyond the circle of coal proprietors themselves. In working some seams 50 per cent., perhaps, is small, and this, although unsaleable, must be brought to surface. It is then a question how is shall be got rid of, and, to save the cost of placing it upon the land, which, of course, is covered up, and can be used for nothing else, hundreds of thousands of tons are burnt, and in some districts enormous banks of slack are burning night and day. This is a great waste and nuisance, which has been severely commented upon by some French engineers, who, however, may not have the same difficulties in the collieries of their country. There are some seams in Somersetshire which produce so much small that they are not worth working, and calculations based upon the mere thickness and extent of a seam are very often in this way found to be fallacious. Some coals break up naturally, and if they are stacked at the surface they are found after a little time when removed for the market to make an enormous proportion of slack.

In some cases the quantity of small is much increased by the method of working, and particularly if the plan should be one which sets up an undue pressure on the pillars, it is found that when those pillars are removed their value is greatly deteriorated. Then, in the mere getting of the coal, something is due to the manner of breaking it down. Undercutting of itself is productive of much waste, and it is often advisable to undercut below the coal instead of in it; this, of course, must depend upon the hardness of the ground, as it may be better to submit to the loss of a certain amount of round coal than pay the colliers for holing in a very hard material. And so in detaching it from the roof, to which its adherence is sometimes very tenacious, whether by driving in wedges, or by breaking it down with hammers or the pick, or with gunpowder, choice must be made of the plan which will produce the least slack. It has been proposed to introduce some system of forcing down the coal which shall be at once powerful and gentle in its action, and there has been very lately an ingenious plan proposed for that purpose. It is an apparatus which practically is an application of the power obtained by hydraulic rams; it is very convenient, and can easily be lifted by two men. A hole is bored in the coal, and two wedges inserted, between which a third is driven in by means of a hydraulic ram, which forces down the coal. It is, of course, impossible to say how far this apparatus may be successful in actual practice, but it seems to have in it the elements of success; it is also said that the machine can be applied so as to bring down the coal without holing, but that has yet to be tested in practice. Another machine for the same purpose, by Mr. Grafton Jones, can also be used without holing, but certainly works with greater advantage with it. With this a hole, 3 or 4 in. in diameter, and 3 or 4 ft. deep, has first to be bored. In this is inserted a hollow cylinder, with numerous small plungers, which the hydraulic pump works, and forcing the plungers into the mass, brings it down. Such machines may prove useful, especially when worked in conjunction with undercutting machines, which hole rapidly, and with less small than is produced by hand labour.

The principal points, then, to be considered before exploitation, besides the general circumstances of the locality are the thickness of the seam, its depth, its strength, the character of the roof and floor, the regularity and amount of probable sale, and whether it is a home or an export trade; the facilities of conveyance to the market or place of shipment; and, lastly, the occurrence of faults, a consideration which is of the greatest moment in some districts. Thus, while North Durham is free from faults, in Flintshire they are so numerous and so close together that it is almost impossible to lay down, *a priori*, the form a colliery there ought to assume. Again, in Lancashire and Staffordshire the faults are well known, and, generally speaking, large; and the workings may be so planned as to run in between the faults without even crossing them. And, again, when the seams come up to the surface it is not unusual to work them at or near the outcrop by open-work, like a quarry, or by bell-pits, or as the lignite beds are worked at Bovey Tracey, in Devonshire, where, having a wet, awkward material to deal with, a system is adopted of opening out large square pits, with a wall, 2 or 3 ft. thick, between them, and so managed that the water from two side pits can accumulate in the middle one, the division walls having to be left as waste. By this means half or two-thirds of the alluvial material is obtained. The Derbyshire bell-pits are ancient, and worked in a peculiar way. There is not a very great thickness of outcrop, and the shaft is sunk right through the bed to be worked. The bottom is then gradually widened, until the opening assumes the shape of a bell, or a bottle, the neck of which would represent the cutting through the overtop, and the larger part of the bottle the working of the mineral. In these cases, when the whole of the mass is removed, another shaft is sunk at no great distance, and, the "bell" being scooped out until near the first one, a short level is sometimes cut between them, and thus by far the greater part of the whole deposit is won. The ground thus worked in Derbyshire has a species of iron in nodules running through it. The most remarkable bell-pits in the world are those of Hungary, belonging to the tertiary strata. In these they descend from 100 ft. to 250 ft. before they begin to work out the mineral. They open out the lower sides of the shaft at an angle of 40°, constantly keeping the roof at the same angle, until at length they descend vertically; and, although the excavations are vast, they are perfectly safe, so long as no water gets into them.

Lecture XXXVIII.—The pillar system is much used in the South of France and in Germany on the large seams, but the methods of working are various. Formerly the object kept in view was to get the pillars as thin as possible, and thus about one-half or one-third of the coal was got; but from about 1790 up to the present time the bords are carried much smaller, and the pillars are very much larger, by which plan they resist the pressure without deterioration, and the pillars being then removed, about 80 per cent. or even more is obtained. On this system the bords are from 4 to 6 yards wide, and the pillars from 30 to 40 yards thick. Some years ago it was suggested by Mr. Buddle that a great saving might be effected, both as to the amount of coal obtained and in the lives of the men, if the work were carried on in districts kept apart by ribs of coal from 40 to 50 yards in breadth, instead of driving to the boundary, and then working back. Thus, one mine might be divided into (say) six districts, or as they are called, panels, and thus giving a chance that if a creep set in in one panel the intervention of such a large mass of coal would prevent it spreading to the other panels. The letting down of the roof in collieries often requires excessive caution, because the sinking thus produced may affect all the superincumbent beds up to the surface, and thus damage buildings or works, and also because every movement of the beds is likely to be followed by the evolution of gases, which, accumulating in the goafs and workings, may endanger the lives of the men. This will be more evident if we consider the effect of removing the pillars. While this is done the roof is propped, but eventually, as the men recede, the props are removed, a vast mass of material comes down, but as almost always openings are left, in which fire-damp accumulates, the pressure from above brings down the other beds, and there may be circumstances which will render it necessary to put in dry walling to prevent so large a subsidence. Much will depend upon the thickness of the seam, its depth, and the nature of the ground. Thus, if the seam be from 3 to 6 ft. thick, and it is at a depth of 200 fms., no effect will be observed at the surface, and the ground will stand, although acres of pillars are removed; but if the depth be only 50 or 60 fms., the effect to a greater or less extent will be observed at the surface. Faults often cause extra danger. If we look back to the history of fallen workings, we shall find many cases in which the pillars have been weakened or removed when they ought to have been left. A remarkable instance of this occurred at a colliery at Workington, in Cumberland, where the seam went under the sea, and almost touched the water. After working on the rise for a time the manager thought it advisable to close that portion, but his successor, although warned, insisted on removing the pillars, when one day the sea came in with such rapidity that 36 men were drowned, and the mine lost. Another argument in favour of panel working, besides that of intercepting the creep, is that separate supplies of fresh air can be conveyed to each panel, and if an explosion were to take place there is great probability that it would be confined to the panel in which it originated. In the North the system has been adopted in a considerable number of collieries.

When seams overlie each other, the question which should be removed first will generally or in part be determined by the demand for coal in the neighbourhood. If, however, they are of about the same quality, we must consider the thickness of strata between the two seams, whether it is such that the removal of the lower seam will injure the upper. If we get the lower first we should take care to leave pillars enough to prevent the roof moving, so as to injure the top seam, till we have got the latter. As a general rule, it is most economical to get the top seam first. Cases, however, have been brought forward in which both these operations have been attended by success. The known facts on this subject are very curious. Mr. George Elliot removed a top seam 20 fms. above a lower seam, but in doing this a movement was set up, which acted prejudicially on the lower seam, and rendered it much more difficult to get. We require more experiments on this point. In the Mostyn Colliery, which is carried under the sea, pillars and bords are driven and left alternately of the same thickness, while in the Whitehaven Colliery, also under the sea, the pillars are 20 yards square, the bords between being 5 yards. In a fine seam, called the Main Band, with 120 fms. of various strata overhead, the pillars have been removed here and there, and as a proof that no movement has reached the surface, the basement of the piers of the Whitehaven Harbour overhead do not exhibit the slightest crack.

As another instance of this pillar working, we may mention the mines for iron ores at Middlesborough, in the Cleveland district. The ore occurs in the Lias formation, from 6 to 15 ft. thick. At the first starting off, however, the bords were opened without sufficient knowledge of the district, and with pillars far too small. It was found that as they began to go into the hill side the openings began to run into one another, the pillars gradually thinning to a wedge shape, and finally a creep was set up, and a settlement took place. However, the management was changed, and now pillars are left 22 yards long and 6 yards broad, with openings from 3 to 5 yards wide. In Lancashire and South Staffordshire.

where a modification is practicable, there is a tendency to leave the pillars smaller, and the bords wider in proportion. In some districts we have, for instance, going up the upbrow at every 10 yards a bord and pillar 10 yards by 60. This working proceeds up to the bords, and then coming back they remove the coal. This has the advantage of simplifying the ventilation with respect to the goaf. It is requisite sometimes to change this form of working, owing to the varying inclination of strata, and in order to get the full advantage of the direction of the cleat, as generally it is preferred to cut the coal perpendicularly to its face or across the line of stratification, and not on its end. In North Wales and the Isle of Anglesea the old system of large openings is adhered to. Wide workings are opened every 5 or 6 yards, with pillars 4 yards square. Thus much coal is wasted, owing to the pillars being so small that they are sure to go to crush. The only wonder is that such a system can be carried out without danger to the men.

Another method, something intermediate between this and the long wall system, has crept into Yorkshire and some of the districts in North Wales, but it has been attended with such dreadful calamities that it is looked upon with much suspicion, and is not to be recommended. From the main level bord-gates are driven out every 90 yards, opening out the distance between in bords from 8 to 9 yards wide, in steps leaving ribs 1 yard wide. The roof is, of course, safe to come down, as the ribs are of no use except, perhaps, to let the roof come down gradually instead of with a crash. Great care must be taken to support the roadways by packing; and all the intervening space goes into goaf. This system has passed away, and wide bords—20, 30, or even 40 yards broad—are opened with no ribs at all. The Lund Hill Colliery, which is one of the best examples of this kind of working, was a few years ago the scene of a serious calamity, when the mine had to be filled with water to put out the fire-damp. The bord-gates are driven out generally in pairs, and the pillars removed on either side. The bord-gates are useful as a guide for faults, and drain the goaf partially of the gases which are sure to be pent up in such places, and near which the men ought always to use safety-lamps. They then take away the coal in banks, 20 or 30 yards wide, the ground breaking down at a few feet behind the banks. It is unfortunate that the men working at the banks are placed within, perhaps, a few feet of the bord-gates, and being liable every minute to tap a blower, the gas may get into the goaf, and become ignited. Still the system is economical, the working thus going on till the boundary is reached, and most of the pillars are got on the return home.

IRON AND STEEL MANUFACTURE.

Almost every attempt made to explain the mode by which iron and steel may be produced of a given uniform quality affords additional evidence of the fact that we still have much to learn concerning the theory of the processes employed. Under these circumstances, a succinct account of the processes by which iron and steel are manufactured at the several works, and of the reputation enjoyed in the market by the various brands, cannot fail to prove of considerable interest to all concerned in the trade. It is to supply such information that the very handsome volume by Mr. Kohn* has been prepared, and, as no pains seem to have been spared to render the work complete, it is certainly entitled to be regarded as an important addition to our metallurgical literature. Mr. Kohn remarks that in ancient Greece, in those classic days when the history of that small country was virtually the history of civilisation, one institution of vast importance, and of unparalleled influence upon the national progress of that time, stood foremost in the mind of every historian, and impressed itself so strongly upon the course of events that it governed the chronological subdivisions of all historical records—the Olympic festivities, the national exhibition for arts and sciences. In modern history, when civilisation is again recognised as the aim and ambition of the majority of all nations, international exhibitions are the Olympic festivities for a nation of nations, for that vast fraternity of mankind for which the word Christendom is insufficiently comprehensive, and which can be recognised in its integrity by no other term than that of "the civilised world." In that sense Mr. Kohn regards the year 1867 as closing an Olympiad in modern history of civilisation.

The Exhibition of 1862 is taken as inaugurating the "age of steel," by bringing before the universal public, as an accomplished fact and a practical reality, that gigantic invention—the Bessemer process, which, during the comparatively short period under review, has changed the industrial and commercial position of every European country, and is now irresistibly sweeping away the old-established iron industry of some manufacturing districts, and, indeed, the whole primitive mode of iron manufacture all over the world. The influence of Mr. Bessemer's invention reaches down to the very mines of ironstone and of coal. One great thought has changed the least appreciated kinds of British iron ores into the first qualities of ironstone in Europe. The British hematites are now in greater demand than any class of iron ore had been at any previous period. The population of the Ulverstone district, and particularly that of Barrow-in-Furness and its neighbourhood, is increasing at a marvellous rate, which exceeds all previous examples in European history. In spite of the recent panic, and the general depression of trade, blast-furnaces are rising in this country wherever hematite ore is accessible. The value of ironstone has risen as compared with that of coal for the manufacture of iron, and the preponderance of those works which owe their high standing in the iron trade to the abundance and purity of their coal is gradually sinking, making room for the ascendancy of the steel-producing localities.

Mr. Kohn very properly points out that a great revolution, thus silently but irresistibly working its way, naturally produces some temporary distress in certain places. The iron trade is stagnant, puddlers' wages decrease, and ironmasters' profits disappear. The change being unavoidable, we can only wish it to take place quickly. The industry of the nation will vastly gain, although some special districts may suffer a momentary, but perhaps not irreparable, loss. The iron manufacture of the European continent has felt a similar effect, and has undergone the same, and even proportionately greater, changes. Sweden and Austria, the countries richest in pure iron ores and poorest in mineral fuel, are indebted to Mr. Bessemer for the revival of a prosperous and rapidly rising iron industry out of the very ruins of a prostrate and bankrupt iron trade. The district around Siegen, in Rhenish-Prussia, the well-known locality from which the spiegeleisen is drawn, is a continental Barrow-in-Furness on a smaller scale. A railway, the Ruhr-Sieg-Bahn, has been opened for connecting the Siegen district with the important iron and steel manufacturing district of which Essen is the centre, and an exchange of coal, coke, and iron ore takes place between these two localities similar to that existing between Ulverstone and Wigan. The iron ores of France are, almost without exception, of a very inferior kind. The Creusot works draw supplies of pure ores from Algiers; Messrs. Petin, Gaudet, and Co., from Sardinia; other ironmasters from Elba; and some, it is believed, even from England, whenever high qualities of iron or steel are to be produced. For the lowest and cheapest brands the fuel, again, in most places is too dear, and so the French ironmasters are behind the Swedish, Austrian, and English with regard to quality, and behind the Belgian, Prussian, and British with respect to the cost price of cheap iron. In spite of these difficulties the iron industry of France has made great commercial progress during the period now under review—a progress, however, which has been considerably overrated by many visitors to the late Paris Exhibition who have been dazzled by the brilliant *mise-en-scene* of that grand display. The United States of America are turning from importation of iron to the manufactore of this material. This is, in Mr. Kohn's opinion, a somewhat premature step, unnaturally stimulated by an unreasonable tariff of import duties. A country like America, he says, has more profitable channels for the development of its natural resources than the sinking of that large amount of accumulated capital required for iron mining, and the slow returns which characterise this steady and conservative branch of industry. To cripple the whole effective power of that great nation, whose characteristic element and mainspring of existence is rapidity of industrial progress—to increase and even to double the price of iron and steel in such a country by artificial means—must be considered as the height of political insanity.

The vague fear which has lately been spreading throughout this country that the British iron manufacture is on its decline, and that the universal ascendancy of the industrial products of Great Britain in the markets of the world is approaching its end, is prominently referred to by Mr. Kohn, who discusses the whole question in a most satisfactory manner. He considers there is, of course, no proper evidence for such an assertion to be traced in the statistics of our iron trade, though we hear of indications of a different kind more readily caught by the eyes of the public. There are veritable French locomotives to be seen running on our English lines, and giving perfect satisfaction to those who imported them. There are Krupp's tyres, specified by the very obstinacy of British prejudice, in the face of the best Bessemer steel, that is made at half their price in this country; there is French and Belgian iron bought by our merchants and shipbuilders; and there are Belgian shipbuilders getting contracts from English firms, while our workmen are on strike, and while parliamentary commissions are discussing the probable duration of our natural supply of coal, and the best means for educating the working classes at a moderate expenditure. The conclusions at which Mr. Kohn arrives concerning the cry that we can no longer successfully compete with iron manufacturers on the Continent are widely different from the distressing prophecies heard around. There is, he says, a great and important change taking place under our eyes in the whole iron industry of the world, and first and most prominently of all in this country—a change which transfers the localities of the great centres of manufacture, and alters the relative positions of many old establishments. This great change Mr. Kohn considers to be due to the Bessemer process. It was predicted long ago, and, in fact, it has taken place more slowly than was at first expected.

The basis of iron-making ever since the invention of the puddling process has been coal. With abundance of coal of tolerable quality almost any kind of iron could by working and re-working be made of marketable value, and the quality of ore was, therefore, a subordinate question to that of coal. The great centres of iron manufacture were by this circumstance naturally placed upon the coal fields yielding the purest fuel, such as Yorkshire, Staffordshire, and Wales. It is universally known that the excellence of the iron obtained from these localities is not due to any superiority of the ore, but simply to the amount of "work" put into the iron, or what is to a certain extent equivalent to it, to the quantity of fuel burnt in producing and re-working it. With the most economical mode of working in the present practice in Staffordshire the making of bars marked as "best best best" corresponds to a consumption of 5 tons of coal per ton of iron made from the forge pigs, which themselves require from 2 to 2½ tons of coal for their production; and considering the waste of iron in puddling and re-working, it may be put down that 1 ton of the best brands of Staffordshire bars represents from 8 to 9 tons of good coal burnt in its manufacture. But with all that these bars will never make steel—the iron is unsuitable for the Bessemer process, and for the old steel melting process it is, of course, still less available. By means of the Bessemer process a ton of steel bars may be made from the pig-iron with the consumption of about 2 tons of coal in all, and one-half of this coal being used for firing boilers may be of very inferior quality. With Siemens' gas furnaces the coal of superior quality necessary under the ordinary system for melting the pigs can be replaced by an inferior kind, and so we find steel-making practically independent of the quality of coal. On the other hand, it has become all the more dependent upon the purity of the ore employed in the blast-furnace, and thereby the basis for modern iron manufacture has been changed from the coal to the ore.

The details given by Mr. Kohn throughout the book are precisely those likely to prove of utility to those practically engaged in the trade, and he has well employed the time which has elapsed since the papers originally appeared in "Engineering" in acquiring the necessary facilities for revising the particulars given, and adding such others as were requisite for making them complete. The volume is profusely illustrated with diagrams of various portions of the plant employed in the works and processes described. The book is one which will unquestionably long enjoy an enviable reputation as a record of the position and prospects of the iron and steel trades at the period to which it relates, and, at the same time, one which will give rise to many suggestions calculated to render the importance of those trades still more extensively recognised.

* "Iron and Steel Manufacture: a Series of Papers on the Manufacture and Properties of Iron and Steel; with Reports on Iron and Steel in the Paris Exhibition, &c., and Descriptions of many of the Principal Iron and Steel Works in Great Britain and on the Continent." By FERDINAND KOHN, C.E. London: William Mackenzie, Paternoster-row.

MINE ENGINEERING.—Mr. G. C. Greenwell's "Practical Treatise on Mine Engineering" has so long enjoyed a high reputation, and regret has been so frequently expressed at its being out of print, that the announcement that the publication of the second edition has been commenced will be received with satisfaction. The value of the work is chiefly due to the sound practical knowledge of its author, whose long experience enables him to speak with authority upon every portion of the subject. When the first edition of the work was issued, it was almost the only work in the English language from which information of a practical character relating to Mine Engineering could be obtained, and it is not improbable that the evidence which it afforded of the enormous advantage derivable from the systematic and scientific consideration of the subject has exercised an important influence in promoting the success of the various mining institutes which now exist in our mining districts. Mr. Greenwell's Treatise is not intended to supersede or replace any of the purely scientific treatises upon mining subjects which have appeared in the Transactions of societies and elsewhere during the last 10 or 15 years, but to instruct the beginner in the art of mining, and to aid those more conversant with it in the execution of mining work. The author remarks that he has frequently been gratified to hear that works have been laid out and executed in accordance with the recommendations contained in his book; and he wishes it to be understood that the instructions contained in it are such as may safely be followed for proper working results. The second edition of the book, the first part of which has just been issued, is to be completed in 16 monthly parts, which, judging from that already published, will be well printed and beautifully illustrated. The principal subjects treated of in Mr. Greenwell's work are—Geology, as applied to mining; classes of rocks commonly met with in mining for salt, coal, and metallic ores; building materials; dykes, slips, and mineral veins: internal heat; metallic ores, and minerals associated therewith, and with coal; smelting; boring and sinking tools; timbering, walling, tubbing; management of quicksands and clay; pumping engines and pumps; winding-engines, ropes, pulleys; strength of timber; ropes and other materials; the working of mines, copper, lead, tin, iron, salt, coal; ventilation, theory and practice; fire-damp, carbonic acid, and other gases; and explosions and other casualties. The book has been entirely re-written, so as to bring it into accordance with our present state of knowledge, and is altogether calculated to prove a valuable acquisition to anyone engaged in mining operations.

DICTIONARY OF ENGINEERING.—The fifth number of this thoroughly practical Dictionary extends to the conclusion of the article on "Artesian Wells." The articles in the fourth number—"Antimony," "Aqueduct," and "Archimedian Screw"—are really good treatises upon the several subjects, and the same may be said of those on "Armour" and "Artesian Wells" in the last number issued. The Dictionary, when completed, will be a really valuable addition to the engineer's library.

PREVENTING LOSS OF LIFE AT SEA.—A circular containing some important suggestions connected with this subject has just been issued by Mr. GEORGE PEACOCK, F.R.G.S., of Starcross, Devon, whose long experience as a steam commander entitles his opinion to the utmost respect. He refers especially to water-tight bulkheads, and the spontaneous ignition of coal on board ship. He has advocated the use of water-tight bulkheads in every class of vessel for 40 years, particularly at the extremities, and many years ago he patented a simple but useful practical invention—to have no sea-cocks in any class of ship below the light load-line, nor bilge-cocks (so called) below the deep load-line, but to have one small chamber on the inside of the ship, either within the water-tight stern division or under the engineer's cabin; a sort of box, made of iron, attached to the side, of convenient dimensions, with one aperture through the ship's side, and a large screw-down valve attached, under the command of the engineer, or a separate box on each side of the ship, one for each engine. Into this box, instead of a dangerous Kingston valve through the ship's bottom, the boilers were to be blown—that is, the water changed every two hours at sea, and for feeding and blowing out or emptying the boilers. The bilge-cocks to be also at the command of the engineer in his cabin, or at the end of the engine-room upper platform, and not down in the bilge, sometimes covered with water, and not to be got at. For the prevention of accident from the spontaneous ignition of coal on board ship, he revives his suggestion, originally made 28 years ago, that all coal ships in future should have a wrought-iron gas-pipe, 2 in. in diameter, fitted up and down the stancheons, leading up to the fore side of the fore hatchway combings on deck, one at the afterpart of the main hatchway combings, and one abaft the mizen mast, leading into the saloon or cabin—the latter with a stationary thermometer fixed at its top; the other two pipes to have screw-caps on them flush with the top of the combings, and sufficiently clear to allow of battening down the hatches. These pipes to be perforated (say) 10 ft. up from the keelson, so that, by unscrewing the caps at sea, a common bath thermometer might be occasionally lowered down, in order to prove the exact temperature of the hold. A sea-cock or screw-down valve to be fitted in all coal-laden ships at the light load-line, with a lever rod for opening or shutting, boxed off from the ship's ceiling, leading into the captain's state room, with an index plate and handle, under lock and key, so that it could be opened or shut only at the discretion of the captain; and the deck pipes might also be used for pouring down water, by hose or funnel, without opening the hatches, in the event of fire. It must be borne in mind that, although apparently by the sounding rod 5 or 6 ft. of water, or more, might be let into the ship, the quantity of water would merely occupy the insterstices of the coal, and after quenching the fire could be easily pumped out. The cost of these appliances would not exceed 10*l.*, and he recommends that all coal-laden ships should be compelled to have them. From the undoubtedly practical value of Mr. Peacock's suggestions, he has certainly entitled himself to the thanks of all interested in promoting security from accident at sea.

BRITISH RAILWAYS, AS THEY ARE AND AS THEY MIGHT BE.—In the *Mining Journal* of April 25, 1868, reference was made to a suggestion by Mr. Raphael Brandon, to modify the present system of fixing railway fares by charging 1s., 6d., and 3d. per journey for first, second, and third-class passengers respectively, regardless of the distance travelled, and in a pamphlet just issued by Mr. John Imray, M.A., C.E. (published by Messrs. Spon, Charing Cross), the impracticability of such an arrangement is pointed out, and a still more impracticable scheme proposed to replace it. Mr. Imray's project is that of Mr. Brandon spoiled. According to Mr. Imray's scheme, the Government are to issue the railway tickets, which are to be sold at every station, and available on any day on any railway. The tickets are to be square for short journeys (under 25 miles), and oblong for long journeys (over 25 miles); white for first, red for second, blue for third-class, and yellow for luggage. Every passenger is to present his ticket on entering a station to have it punched with the name of the station. The passengers whilst travelling are to wear their tickets like a badge, so that the railway officers may detect those travelling in the wrong class. On leaving the railway the passenger is to deliver his ticket to the collector. Travellers without a ticket are to pay double fare. Luggage not carried by passengers to have one ticket per hundredweight affixed. The prices are to be—Square tickets: first-class, 1s.; second, 6d.; third, 3d. Oblong tickets: first, 16s.; second, 8s.; third, 4s. Luggage tickets for any distance, 1s. A subsequent provision limits the application to 100 miles, except the journey be on one company's line. It will be seen that the amount of labour necessary for carrying on the railway business of the country would certainly not be lessened by Mr. Imray's scheme, the non-dating of the ticket being the most striking change, except the alteration of the *principle* of charging fares; and the only opinion that can justly be formed of the project is that "what is useful is not new, and what is new is not useful." Mr. Imray considers the same system could be applied to goods. He suggest tickets for long and short journeys, subdividing the goods into classes, as they are practically distinguished now. Coals, minerals, manure, &c., would form the third-class; light, valuable, and perishable commodities the first; and intermediate goods the second. The book is well worthy of careful perusal.

POPULAR SCIENTIFIC LECTURES.*

The first of these lectures, on the Life of the Marquis of Worcester, was delivered at Greenwich; and the second, on Chimeras of Science, was the inaugural lecture of the last winter session of free lectures at the Crystal Palace. We have here an epitome of Mr. Dircks' larger Memoir of the Marquis of Worcester, bringing together, for the first time, in a popular form, what has never hitherto been accomplished—that is, a truthful notice of facts in connection with the life of the undoubted inventor of the steam-engine. Previously it had been the custom to supply every hiatus with some vague surmise or other, and, as each writer exercised his ingenuity as best he could, it became at length difficult to ascertain where the truth lay. Some declared he wrote his "Century" while confined in the Tower, others supposed he wrote it in France; Mr. Dircks shows that he wrote it after his release from imprisonment. According to the date of her decease, as given in all genealogical charts, the Marquis' first wife would be living when he married a second time. This absurd mistake Mr. Dircks has cleared away, by producing the certificate of Lady Herbert's death and burial. And so on throughout his large and more laborious work he has authenticated all he advances, and placed in quite a new light what cannot fail to interest all who pride themselves on their country's contributions to the advancement of civilisation and the promotion of trade and commerce, all so largely benefited by the invention of the steam-engine.

Mr. Dircks seems to be quite at home on the Chimeras of Science. He refers to various works on astrology, alchemy, and mathematical and mechanical chimeras, not omitting his own "Perpetuum Mobile: or, History of the Search for Self-Motive-Power"—a work likely to be highly useful to young mechanics at their studies, and to older ones who have neglected them. Mr. Dircks concludes that—"Astrology is merely a philosophism, being empirical, wholly visionary, a mere fanciful system, compounded of incongruous mixtures of astronomical with human events, of mythology with theology, and of facts with pure fiction;" and that, while laying claim to the remotest antiquity, it makes no pretence to inspiration. Treating on alchemy, the author states that—"Alchemical writings are very numerous; they may be estimated at from 3000 to 4000 works, and an astonishing number of manuscripts." So insinuating was this delusion that Lord Bacon, Luther, Spinoza, Leibnitz, and many eminent moderns believed in finding the philosopher's stone, the gem of the Hermetic philosophy. Next follow the squaring the circle, duplication of the cube, trisection of an angle, and perpetuum mobile, illustrated by means of neatly-engraved diagrams, to accompanying explanations. Among the squarers preference has been given to Mr. James Smith, of Liverpool, in plate 3. Arago declared that all that could be gained in computing "the area of the space included within a circle of thirty-eight millions of leagues radius may be determined within such a degree of precision that the probable error shall not exceed the space of a mite," or grain of sand, as others remark.

These lectures, notwithstanding their popular character, are replete with information, and cannot be read by the studious without satisfaction and benefit, as their author brings to bear on them a vast store of curious reading, and the results of years of practical experience.

* "Scientific Studies; or, Practical, in contrast with Chimerical, Pursuits: exemplified in two popular Lectures." By HENRY DIRCKS, C.E., LL.D. Post 8vo. E. and F. N. Spon.

ON THE GOLD FIELDS OF SCOTLAND.

BY W. LAUDER LINDSAY, M.D., F.R.S.E., F.L.S.

The author's conclusions* are based on—1. Personal survey of the gold fields of New Zealand. It was while visiting, in 1861, the auriferous districts of the province of Otago that he was struck with the similarity, as respects physical geography and geology, between that country and many parts of Scotland, and with the probable parallelism as respects the distribution of gold.—2. Personal comparative survey of Scotland, and its principal outlying islands, since his return to Scotland in 1862, in order to determine how far such a parallelism really exists.—3. Inspection of the specimens of gold and gold rocks in the principal international exhibitions and national museums of Britain and France, Australia, and New Zealand.—4. Comparative study of the literature of gold in Scotland and other auriferous countries.

His special conclusions as regards the Scottish gold fields are founded mainly on—1. The similarity of the rocks (Lower Silurian) of a great part of Scotland to those of most other auriferous countries.—2. The abundance in Scotland of the minerals with which gold is most commonly associated in the richest auriferous countries, *e.g.*—*a.* Metallic oxides (iron and copper); magnetic ironsand, containing (or not) oxide of titanium. *b.* Metallic sulphides (iron, copper, lead; and zinc).—3. The actual discovery of gold, both in recent and former times, at various points between the extreme north and south of Scotland—*e.g.*, Lanarkshire and Sutherlandshire.

His propositions concerning the gold fields of Scotland are that—Gold is much more extensively or generally diffused over Scotland than has hitherto been supposed; and that the Scottish gold fields may be divided geographically or topographically into two great areas—*a. Great Northern*, which is naturally sub-divided by the Caledonian Canal. The northern half occupies the longitudinal axis of the northern peninsula of Scotland, and comprises the greater part of the counties of Sutherland and Ross, and of Inverness and Argyle north of the Caledonian Canal. The southern half lies between the said Canal and the valley of the Tay, and forms a transverse belt across Scotland, comprising a great part of the shires of Inverness and Argyle south of the canal; and of Aberdeen, Banff, Kincardine, Perth, Forfar, Stirling, and Dumbarton shires.—*b. Southern*, includes great part of Dumfries, Kirkcudbright, Wigton, Ayr, Selkirk, Peebles, and Lanark shires; and more particularly parts of the districts of Nithsdale, Annandale, Eskdale, Ettrickdale, Tweeddale, and Clydesdale; Carrick; and the Lammermuirs (in Haddington and Berwick)—all south of the Forth.

Actual discoveries of gold have been made at different times in the following localities:—

Sutherlandshire—Kildonan on Helmsdale Water, Durness.

Perthshire—1. Breadalbane: area of Loch Tay and head waters of the Tay (Tyndrum and Taymouth).—2. Upper Strathearn: area of Loch Earn and head waters of the Earn (Glen Lednock: streams falling from the north into Loch Earn; Ardvoirlich, south side of Loch Earn; Glenturrit).—3. Glenalmond: Glenquoich and other valleys of the Grampians.

Forfarshire—Clova district: "Braes of Angus," Edzell, and Glenesk.

Aberdeenshire—Area of the Dee (Braemar, Invercauld, coast about Aberdeen).

Argyleshire—Dunoon.

Lanarkshire—Headwaters of the Clyde, including the rich Crawford Moor or Leadhills district (Elvan Water, Glengonner, Glencaple, Mennlock and Wenlock, Short Cleuch, Lamington Burn).

Peebles-shire—Headwaters of the Tweed (Mannor Water, which flows north to the Tweed; Megget Water, which flows south to St. Mary's Loch; various feeders of the Yarrow; Glengaber).

Dumfries-shire—Headwaters of the Annan (Moffatdale: streams falling into Moffat Water; Hartfell range above Dobbs Linn).

The richness of the Scottish gold fields is illustrated by the following facts:†—The limited area of the Leadhills yielded at one time (sixteenth century), to systematic working, half a million worth of gold. In various public or private museums *nuggets* of Scotch gold are exhibited, of the following weights—(1) 2 lbs. 3 ozs. = 27 ozs. = 12,960 grs., worth at current price of gold in Australia (= 4*l.* per oz.), 108*l.*; Leadhills. Collected about 1502 [the largest mass of native gold recorded as having been found within historic times in Scotland].

* Details will be found in a paper on the "Gold and Gold Fields of Scotland," in the Transactions of the Geological Society of Edinburgh for 1867-68. Part II.

† Dr. Hill Burton, the learned historian of Scotland, is of opinion that the gold torcs and other ornaments of prehistoric age found in different parts of our country were, there is every reason to believe, the produce of *native gold*.

—(2) 2 ozs. = 960 grs.: Breadalbane.—(3) 1 oz. 10 dwts. = 720 grs.: Leadhills.—(4) 10 dwts. = 240 grs.: Kildonan.—(5) 30 grs.: Leadhills (1863); 6 grs.: Moffatdale (1863).—Nuggets of 2 or 3 grs. are frequently found at Leadhills at the present day.

Geologically the area of the Scottish gold fields corresponds to that occupied by the Lower Silurian strata and their drifts; in the south represented by the grauwackes and graptolitic slates of the Lowthers; in the north by the micaceous schists of the Grampians.

Gold in Scotland is *not*, however, necessarily confined to the Silurian area. In other countries it has been found in rocks of so many different characters and ages that it is impossible to assert that gold will *not* be found in any given district or rock in Scotland. In particular, gold has been found in Laurentian rocks in Canada, Nova Scotia, and Sweden; hence it may at least be looked for in the area of Laurentian gneiss in Scotland—in the Hebrides and western seaboard of Sutherland and Ross shires. In Canada it occurs also in the Upper Silurian strata; so that it is possible our Pentlands may prove to be auriferous. In California, Australia, New Zealand, and other auriferous countries gold occurs in rocks of more recent age, as well as in granites, syenites, sandstones and limestones, and their débris, apparently of very different ages. The area of diffusion of gold in Scotland, and the extent to which it occurs, can only be determined by systematic investigation, equivalent, at least, to the "prospecting" of gold diggers. Hitherto, with certain limited and local exceptions, there has been no such systematic gold "prospecting" in Scotland. "Prospecting" for gold should form part of the duties of the staff of the National Geological Survey of Scotland. From its simplicity it is, moreover, an operation quite within the powers of all classes of the community, who possess, with the necessary interest in the subject, the requisite leisure and local opportunity. There are indications (if they do not always amount to proofs) of the existence in Scotland of auriferous *quartzites*—of gold *in situ*—as well as of auriferous "drifts" and "alluvial gold." Gold in its matrix has been apparently found, at least in Leadhills, Tweeddale, and Breadalbane.

At the present high rate of wages for skilled labour, and with the present rude appliances for its collection, gold gathering in Scotland is not apparently remunerative as a regular and separate industry. It is remunerative only to those classes of the population the value of whose labour does not exceed 3d. per day, the wages of lead mining averaging 15s. per week. But the Leadhills miners find it a profitable occupation for their leisure hours, and they obtain a ready market for considerable quantities at prices varying from 5d. to 7½d. per grain = 12*l.* to 15*l.* per oz. Gold to the extent of 500 to 1000 grs. is occasionally collected in Leadhills in a few days for the local proprietors. These values and estimates refer exclusively to the Leadhills district, Lanarkshire, in the autumn of 1863. The prices quoted are for mere cabinet specimens, or specimens for special purposes, collected *to order*—the lead miners possessing virtually a monopoly of gold collecting in their district. But the case is materially altered on the present Sutherland gold field, where gold is collected *for sale* by a large and miscellaneous class of diggers, most of them having gained a valuable experience as gold collectors in New Zealand or Australia. In Sutherland the market price of the native gold is only 4*l.* per oz., at which price it meets with ready sale on the spot, as well as in Inverness, Glasgow, and Edinburgh. There the largest nuggets yet collected range from 1 to 5 dwts., but the diggins are yet in their infancy, and much heavier "finds" may with confidence be expected when the weather, on the one hand, and the favour of local proprietors on the other, enable the diggers to carry out their operations on a suitable scale. Before it can be properly discussed how far or whether gold-washing is destined again to become a national industry in Scotland, it must be determined what is the extent and richness of the Scottish gold fields. Present data are of the most imperfect and unsatisfactory kind for determining this point. Many improvements have been made of late years in the process of extracting gold from its matrix and drifts; their effect has been to render it remunerative to collect gold which exists in quantities formerly considered too small to be profitable to work. Hence, in so far as the processes hitherto adopted in Scotland have been of the most primitive kind, it is possible it may yet be found expedient systematically to work on the most modern plan some, at least, of the gold deposits of Scotland—*e.g.*, those of Sutherland.

Regarding it as a type of the Scottish gold fields, the author described in detail the gold and gold rocks of Leadhills (to which he made a special visit in the autumn of 1863), pointing out the numerous parallelisms between it and the Tuapeka gold field of Otago, New Zealand. He instituted certain other comparisons—*e.g.*, between the gold fields of Scotland and those of Hungary (Transylvania), especially as regards the remunerativeness of gold-washing to gipsies and other idle or nomad classes of the population. In conclusion, he indicated the present vigorous operations of gold mining or washing companies in Wales and Ireland as an encouragement to systematic investigation in Scotland.

NORTH OF ENGLAND MANUFACTURED IRON TRADE.

ESTABLISHMENT OF A BOARD OF ARBITRATION.

A meeting of the representatives of masters and operatives engaged in the manufactured iron trade in the North of England met, on Monday, in the Central Hall, Darlington, to consider a code of rules drawn up by a sub-committee appointed at the meeting held in the same place on the preceding Monday, the rules being framed for the regulation of the proposed Board of Arbitration and Conciliation.

The sub-committee consisted of Messrs. D. Dale, John Bell, W. R. I. Hopkins, W. Whitwell, G. W. Jeffray, and John Jones (secretary), representing the masters; and Messrs. Edward Wood, James Croft, John Ridge, Thomas Jones, James Dolman, and J. Kane (secretary), representing the operatives. The meeting was of the most harmonious and friendly character, and the rules were discussed in the most conciliatory spirit, every desire being mainifested on both sides to establish the board on a basis alike acceptable to operatives as to masters. Amongst the delegates who attended the meeting were Mr. Edward Williams (Bolckow, Vaughan, and Co., Limited, Middlesborough), Mr. E. Wood, Mr. W. Everett, Mr. Jos. Croft, Mr. W. Dale (Consett Iron Company, Limited), Mr. J. Priestman, Mr. William Thompson, Mr. John Hunter, Mr. William Barningham, Mr. A. Atkinson, Mr. John Jones, Mr. Thomas Jones, Mr. Edward Trow, Mr. Fred. Dawson, Mr. T. Fry (Fry, Janson, and Co.), Mr. J. C. Janson, Mr. W. Colman, Mr. Clarke, Mr. David Williams, Mr. W. R. I. Hopkins (Hopkins, Gilkes, and Co., Limited), Mr. Charles Price, Mr. Henry Keeling, Mr. W. Scott, Mr. Daniel Jones, Mr. Edward L. Pease, Mr. W. Pease (Pease, Hutchison, and Co.), Mr. Wm. Cox, Mr. George Haigh, Mr. G. W. Jeffray (Richardson, Thomas, and Sons), Mr. James Lenegan, Mr. Andrew Williams, Mr. Jos. Lansdown, Mr. Wm. Rees, Mr. Thos. Gibbon (Stockton Rail Mill, Limited), Mr. John Matthews, Mr. John Bell (Tyzack and Co.), Mr. John Ridge, Mr. Alex. Gunn, Mr. Marshal Fowler, jun., Mr. Wm. Prosser, Mr. William Whitwell (Whitwell and Co.), Mr. Thomas Whitwell, Mr. C. Bever (Palmer and Co.)

The CHAIRMAN opened the proceedings by remarking that the committee of masters and men appointed at the last meeting had drawn up rules for the formation and guidance of a Court of Arbitration and Conciliation, that would have to be considered by the present meeting, which would be asked to adopt them. The rules were then gone through, and discussed *seriatim*, which occupied several hours. The meeting, with the interval of an hour for refreshments, extended from half-past ten till five.

The following is the code of rules as ultimately adopted:—

1.—That a "Board of Arbitration and Conciliation for the Manufactured Iron Trade of the North of England" be now formed.

2.—That the object of the said board shall be to arbitrate on wages or any other matters affecting their respective interests that may be referred to it from time to time by the employers or operatives, and by conciliatory means to interpose its influence to prevent disputes, and to put an end to any that may arise.

3.—The board to consist of one employer and one operative from each works joining the board; any works more than five miles apart, though belonging to the same firm, may claim to be treated as separate works.

4.—The employers to hold a meeting in the month of December in each year, and to select a representative from each works, whose name must be given in to the secretaries on or before January 1.

5.—The operatives of each works to select a representative by ballot, in the month of December in each year, the name of such representative to be given to the secretaries on or before January 1.

6.—The representatives so chosen to continue in office for the calendar year, immediately following their election, and to be eligible for re-election.

7.—If any representative die, or resign, or cease to be qualified by terminating his connection as employer or operative with the works he represents, a successor shall be chosen within one month, in the same manner as is provided in the case of annual elections.

8.—That each representative be deemed fully authorised to act for the works which has elected him, and that all decisions by a majority of the board, or of its referees, be binding upon both employers and operatives of all works which have joined the board.

9.—That at the first meeting of the board, to be held on the second Monday in January in each year, the due election of its members be verified, and that there be chosen a President and Vice-President, one from the employers and the other from the operatives, and two secretaries, who shall continue in office till the corresponding meeting of the following year, but shall be eligible for re-election. The President and Vice-President shall be ex-officio members of all committees.

10.—That at the same meeting of the board a standing committee be appointed, to consist of four employers and four operatives, in addition to the President and Vice-President, reference being had in the selection to the desirability of representing the various departments of the trade.

11.—All questions shall, in the first instance, be referred to the standing committee, who shall investigate and endeavour to settle the matters so referred to it, but shall have no power to make an award. In the event of the committee being unable to settle any question, it shall, as early as possible, be referred to the board.

12.—That the President shall preside over all meetings of the board, and in his absence the Vice-President. In the absence of both President and Vice-President, a Chairman shall be elected by the meeting.

13.—That all votes be taken at the board by ballot; that no Chairman of the board be entitled to any second or casting vote; that if at any meeting of the board the employer representative, or the operative representative of any works be absent, the other representative of such works shall not, under the circumstances, be entitled to vote.

14.—In case of an equality of votes at the board, it shall appoint an independent referee, whose decision shall be final and binding on all works which have joined the board.

15.—That the board shall meet for the transaction of business once a quarter—the second Monday in January, April, July, and October, at Darlington, Stockton, Middlesbrough, and Newcastle alternately, but on a requisition to the President, signed by five members of the board, specifying the nature of the business to be transacted, and stating that it has been submitted to the standing committee, and left undecided by them, he shall, within 14 days, convene a meeting of the board. The circular calling such meeting shall specify the nature of the business for consideration.

16.—That all questions requiring investigation shall be submitted to the standing committee or to the board, as the case may be, in writing; to be supplemented by such verbal evidence or explanation as they may deem needful.

17.—No subject shall be brought forward at any meeting of the standing committee, or of the board, unless notice thereof be given to the secretaries seven clear days before the meeting at which it is to be introduced.

18.—That the standing committee shall meet for the transaction of business on the second Monday in March, June, September, and December, and, in addition, as often as business requires. The place of meeting to be arranged between the President and secretaries in default of any special direction.

19.—That any expenses incurred by this board be borne equally by the operatives and employers, and that it be the duty of the standing committee to establish the most convenient arrangements for collecting what may be needed to meet the expenses.

20.—That the sum of 8*s.* be paid to each member of the standing committee for each attendance at a meeting of that committee.

21.—That if any works desire to join the board at any other time than as contemplated in rules 4 and 5, such desire shall be notified to the secretaries, and by them to the standing committee, who shall thereupon admit such works to membership on being satisfied that representatives have been chosen in the manner prescribed by the rules.

22.—That no alteration or addition be made to these rules, except at the first meeting of each year, and unless notice in writing of the proposed alteration be given to the secretaries at least one calendar month before such meeting. The notice convening the annual meeting to state fully the nature of any alteration that may be proposed.

It was decided that both employers and employed, who formed the Board of Arbitration, should have their railway expenses defrayed by the bodies they represented. It was decided to hold the first meeting of the board at the Central Hall, Darlington, on the 22d inst., the men in the meantime to hold meetings and select their representatives.

MANCHESTER STEAM USERS' ASSOCIATION.

The annual meeting of this association (heretofore known as the Association for the Prevention of Steam-Boiler Explosions, but which has been newly named) was held, on Tuesday, at Manchester,

Dr. FAIRBAIRN, the President of the association, in the chair.

Mr. R. TONGE (the secretary) read the report for the past year, of which we gave an abstract in last week's Journal.

The CHAIRMAN, in proposing the adoption of the report, expressed his gratification at the position and prospects of the association. Since the introduction of the principle of guarantee the association had enlarged its sphere of influence, and conferred great benefits and increased security to its members. Never a single explosion had occurred since the introduction of the guarantee. The association had enrolled in its list a greater number of boilers—amongst others those of the Government—than it ever had since its foundation, and if to these was added a considerable increase of corresponding members, they might safely calculate on a proportionate increase of revenue, and the means for exercising those duties which have been so usefully practised during the existence of the association. The engineering department, on which he was more frequently consulted, was in a satisfactory state. Mr. Fletcher, their able engineer, stated that during the past year there had been no explosion to any of the boilers under the charge of the association, though many of them are worked up to a pressure of 60 to 70 lbs. per square inch, and even upwards in some cases. Last year, however, outside the ranks of the association, there had occurred no less than 45 explosions, injuring 117 persons, 57 of whom were killed. In 1867 there were 36 explosions, from which 60 were killed and 67 seriously injured. In 1866 there were 72 explosions, injuring 196 persons, 87 of which cases were fatal; and in 1865, 48 explosions occurred, in which 46 were killed and 79 seriously wounded. Thus during a period of four years we had on record—independent of unknown casualties—201 explosions, 250 persons killed, and 315 seriously injured. None of these boilers were under the inspection of the association. These facts said much for the system of independent periodical inspection, on which the association was founded. Great importance was attached to frequent internal and flue examinations of the boilers, which were made not less than once a year. Upwards of 2000 had been examined during the past year, and some of them had received more than their annual examination. This was always repeated when there was any cause for anxiety or signs of corrosive action. In addition to this, all the boilers were inspected when at work with steam up, at least twice in the course of the year, when the safety-valves, water-gauges, blow-off cocks, &c., were all carefully examined. This constant routine of examination was attended with very considerable expense. In some cases, inspectors had to travel a distance of 200 miles to make an internal and flue examination, and that to suit the convenience of the members. The monthly reports of the association were probably the most valuable records which could be offered to the members. From the commencement the association undertook this task single-handed, and a mass of information on the causes of explosions, the management of boilers, and other conditions necessary to be observed in the raising, maintaining, and use of steam was gratuitously circulated through the press to the public. It was surprising that in this country, where we were surrounded in almost every direction by steam boilers and engines, we should resort to some mysterious cause—such as magnetism, the formation of gases, or some other destructive agent—to account for explosions; whereas the truth was that boilers burst because they were unfit for use, either from being badly made in the first instance, or worn out in the second. On these occasions the fault was too often laid upon the poor stoker—who was either killed by the explosion or too poor to defend himself—in order to exculpate the boiler-maker for having made a bad boiler, or the owner for having used it. Hence the importance of the association's constant investigations and its valuable monthly reports. The Chairman then directed attention to coroners' inquests on deaths occasioned by boiler explosions. At these courts the most frivolous evidence was accepted, and a verdict of accidental death was almost always recorded. These verdicts were often inconsistent with facts, and it was much to be regretted that there was not some better system of investigation, and that more competent witnesses were not brought forward to assist the coroner, and ascertain the true cause of these disasters. He believed it was the wish of the coroners themselves that more competent evidence should be brought forward, but they had no means at their disposal to remunerate scientific witnesses. A paper on this subject was read at the Norwich meeting of the British Association for the Advancement of Science of last year, by the chief engineer of the association. A committee, of which he (the Chairman) had the honour to be president, was appointed, and he trusted that the committee would be prepared to report that further steps might be taken to remove the present evils and establish investigations more consistent with truth. Smoke prevention had from the beginning been an object of earnest solicitude on the part of the association, and it was his opinion that every difficulty would disappear provided they went energetically to work, and received the support of the members and the public. He was the more anxious on this question, as he was convinced the nuisance might be very greatly mitigated, if not entirely suppressed. The extensive series of coal trials led the way to this new and important investigation, and, so far, they had done good work in the abatement of a grievous and intolerable nuisance. With the co-operation and cordial support of the members they might reasonably hope that every chimney of the association would be rendered practically smokeless. The Chairman in concluding, noticed another subject of great public importance. Nearly 20 years ago he advocated the introduction of high-pressure steam, and even went so far as to suggest that steam of 150 lbs. to 200 lbs. per square inch might be worked with a saving of one-half to two-thirds the quantity of fuel at that time consumed. These suggestions had, to a certain extent, been realised, but there was still much to be done. Experiments were now in progress to prove the efficiency of high attenuated steam, worked at pressures varying from 180 lbs. to 200 lbs. down to that of the atmosphere, and ultimately condensed. This would give a large rate of expansion, and provided the vessels and cylinders through which it passed were well made and well clothed, to prevent the escape of heat, we might look for the reduction of consumption of good coal down to 1¼ lbs. to 2 lbs. per indicated horse power per hour. Many difficulties might have to be surmounted in the construction of engines before this was accomplished, but we had many engineers, some of them amongst their own members, fully equal to the task, and he should like above all things to finish his own professional labours in contributing to the principle of attaining so important a desideratum as an enlarged economy in the use of steam. (Cheers.) He then formally moved the adoption of the report.

Mr. HUGH MASON, in seconding the motion, was glad to see the subject of coroners' inquests again taken up. The Chairman was a boiler-maker and he (Mr. Mason) thought he should, in following him, be perfectly safe if he animadverted with a little severity on the shortcomings of boiler-makers. (A laugh.) He was afraid the attention of the association hitherto had not been sufficiently directed to the preservation of life and the prevention of fatal accidents, but that its energies had been more generally directed to the material saving, and to the advancement of the material interests of steam users; and that too little regard had been paid to the comfort and to the life of those to whom they entrusted the management of their boilers. He found, from a table which had been compiled of the boiler explosions during the past year, that 57 persons had been killed and 60 seriously injured, giving a total of 117, and that the causes of these explosions might be thus stated:—In the ratio of one explosion through the negligence of the boiler attendant, there had been two explosions from the defective condition of the boiler (which he attributed to the neglect of the owner); and four explosions were owing to the malconstruction of the boilers, or, in other words, to the negligence of the makers. Accidents due to this last cause had resulted in 28 deaths, those due to the defective condition of the boilers in 15; and those attributable to negligence on the part of stokers in 7. Mr. Mason went on to say that he attributed a large portion of these accidents to coroners' juries. If these juries had investigated the causes of boiler explosions more carefully, if they had called in scientific witnesses, and received their testimony, as they ought to have done, and if the persons who composed the juries had been selected from an intelligent and suitable class, he thought the findings of those juries and the character of their verdicts would have been very different to what they had been. (Hear.) It almost variably resulted that the verdict of a coroner's juries in one of these cases was "accidental death;" or the fault was said to be the inattention of the fireman, the poor fellow himself having been blown into eternity. Now, from the investigations which had taken place, he was very much disposed to take the side of the fireman, and to say that juries, if they had made suitable investigations, would have given in a very different kind of verdict to that of laying the whole of the blame on the stoker. Further, he was not disposed to place the amount of blame on the boiler-maker which the table he had quoted might seem to warrant. He believed that if the user of the boiler would be a little more liberal in giving a fair price for a good article, instead of haggling about the price, the maker would produce an article which would be better, safer, and, therefore, much cheaper in the end. (Hear, hear.) The whole subject was a very important one, and, notwithstanding the great pressure of public business, he thought that the Home Secretary might, if waited upon by an influential deputation, be induced to take this matter up. (Hear, hear.)

Mr. R. H. GREG, of Stockport, moved the next resolution:—"That the name of this Association be modified, and instead of remaining as at present 'The Association for the Prevention of Steam-Boiler Explosions, and for the Attainment of Economy in the Use of Steam,' that it be henceforward 'The Manchester Steam Users' Association for the Prevention of Steam-Boiler Explosions, and for the Attainment of Economy in the Application of Steam,' so that it may be cited in brief as 'The Manchester Steam Users' Association.'"—Mr. JABEZ JOHNSON, of Bolton, seconded the motion, which was carried.

Mr. THOMAS SCHOFIELD, of Cornbrook, moved:—"That this meeting hears with satisfaction that steps have been taken during the past year for arousing public attention to the present unsatisfactory character of the investigations conducted by coroners regarding the cause of steam-boiler explosions, as well as to the erroneous verdicts constantly returned, and requests the committee of management to take such further steps as they may find necessary to secure these investigations being rendered more satisfactory, so that the truth may be fully arrived at, and plainly spoken in each case, in order to prevent the constant recurrence of these fatal catastrophes." He believed that under a more rigorous system of enquiry into the so-called accidents, employers would be compelled to be much more careful, and the result would be an immense saving of human life. One of the chief causes of these disasters, in his opinion, was the apathy and carelessness of employers. He thought they might fairly say that they had in that association the cream of the steam-users of the community, who were fully alive to their manifold responsibilities. Taking all the circumstances into account, he wondered not that there were so many, but that there were so few boiler explosions.—Mr. C. J. POOLEY, in seconding the resolution, pointed out how, on scientific grounds, these enquiries should be conducted in a more complete manner than at present. Much as steam-boiler users knew, there was yet a great deal on which they had absolutely no trustworthy information, and he thought that careful, scientific examination into all cases of boiler explosions would result in a large augmentation of their stock of practical knowledge. He exhibited some drawings of a superior engine, which his own firm had at work, and incidentally mentioned that they required a strap of leather for it 2 yards wide, and, as no one to whom they spoke on the spot was able to supply them with a strap of this width, they had to send to New York for it.—Mr. W. RICHARDSON, of Oldham, supported the resolution. To show how necessary boiler inspection was, he mentioned that, although there had been no mishap to the boilers belonging to the members of the association, no less than 64 had been reported during the year as "dangerously weak," and a great number had defects which, unless at once attended to, might have developed into sources of serious mischief.—The resolution was carried.

Mr. S. RIGBY, of Warrington, moved "That the benefits derived from membership with this association are not confined to questions of safety merely, but embrace others of importance to steam users, such as the prevention of smoke, the best construction and equipment of boilers, &c."—Mr. COWELL, of Patricroft, seconded the resolution, which was adopted.

Thanks were voted to the officers of the association for their services during the year, and those for the ensuing year were re-elected or appointed; and the proceedings terminated with a special vote of thanks to the Chairman for presiding at the meeting, as well as for his interest in and constant service to the association.

SUGGESTED IMPROVEMENTS IN COLLIERY WORKING.

The following circular letter has been issued by Mr. P. Higson, the Inspector of Mines, to the colliery proprietors in his district:—

"The number of casualties and the great and serious loss of life in and about the coal mines of this district in the year 1868 must have produced the most painful reflections. They have placed those immediately connected therewith in an unenviable position before the public, and they have drawn the attention of all to a state of things which should cease to exist as soon as possible. The accidents referred to herein have happened from explosions of inflammable gas and gunpowder, from shots igniting while being stemmed, from falls of roof and falls of coal, from recklessly running trams and tubs below ground; by travelling on and being at the foot of inclined planes while the machinery was in motion; from unskilful winding, from incautiously moving railway trucks above ground, and by attempting to extinguish standing fires in mines with water. I find that firemen and coalminers neglect to fix props and sprags till the places become actually dangerous from falls. They trust to sounding the roofs and sides with a hammer or pick, although they must now know that large blocks of stone will sound solid, and then fall without warning. To avoid loss of life from this source almost daily caution seems necessary. Props should be regularly fixed, in all working places, within a short distance from the face, even though the roof may appear to be safe. The great loss of life from the unskilful use of gunpowder clearly proves that blasting in mines which emit inflammable gas should be at once discontinued for getting coal. In those mines which do not give off gas it should only be allowed under competent supervision. In blasting, an iron instead of a wooden or copper rammer is still too often used in getting the wadding and first part of the stemming fairly bedded on the powder. Shots which have missed fire are still drawn, although experience shows that, even with water in the hole, the drill goes in advance and ignites the powder. When a charge has missed fired it should not be drawn, but a second shot should be placed so near as to fire both charges. No work person should be allowed to take down the pit more gunpowder than he will require in one day. As brattice so frequently gets disarranged, strong objections will be raised in future to its extensive use. Although it may be indispensable for conducting the ventiliation from one cut through to another on the main roads, when the length is limited, it should not be made a reliable means of ventilating workings in previously unexplored ground, nor until the gas has been partially drained off by double air roads. Many lives are lost annually on inclined planes, which has rendered the absolute necessity of preventing persons going thereon, and of preparing separate and distinct roads for them to travel on to and from their work, an obvious and an unquestionable result. I have to call your attention to a system which has recently grown into a source of evil; it is that of leaving small pillars of unworked coal too far behind the main group of workings surrounded on three sides by the goaf. Such outlying portions of coal can only be recovered under great and unnecessary risk, loss of life therefrom being of frequent occurrence. This generally is an unmistakable mark of bad management, which should in all cases be avoided. Several mines having recently taken fire, which by unsuccessful efforts to extinguish many lives have been lost, I take this opportunity of suggesting, for your future guidance, that the safest way of putting out a fire is to prevent the access to it of atmospheric air. I have also to call your attention to the 8th general rule of the Act 23 and 24 Vict. c. 151, which does not appear to have been generally observed, and to remind you that for any neglect or omission thereof, or of the special rules thereunder established, proceedings against you may be taken under the powers granted by the said Act; and I do hereby give you notice that I require covers to be provided and used overhead when lowering or raising persons in all working pits or shafts, except in those worked by a gin or windlass, or when sinking or attending to the pumps, or in special cases for which my written exemption has been previously obtained."

THE LARGEST ROPE IN THE WORLD.—It is, perhaps, hazardous to say of anything that it is the largest specimen of its kind in the world. But we may fairly say this of an enormous rope just made by our townsmen, Messrs. John and Edwin Wright, Universe Works, Garrison Street, so widely known by their share in the production of all the principal ocean telegraph cables, including the new French Atlantic cable, now in course of construction. We have more than once had occasion to mention Messrs. Wright's extraordinary performances in rope making; but this latest one is so extraordinary as to merit special commemoration. The rope, which is intended for shipment abroad, is 11,000 yards long, measures 5¼ in. in circumference, and weighs over 60 tons! These figures are enough to take one's breath away; but when we come to see how the monster is built up, there is cause for still greater surprise. The rope (made of Messrs. Webster and Horsfall's patent charcoal wire, laid round a hemp centre) consists of six stands, with ten wires in each stand. Each wire measures 12,160 yards; so that the entire length of the wire reaches the enormous total of 726,000 yards, or 412½ miles. To this has to be added the length of yarn used for the centre—namely, 27 threads, made from Petersburg hemp, each thread measuring 15,000 yards, and giving a total length of 405,000 yards, or about 230 miles. Adding together the wire and yarn, we have a grand total of 1,131,000 yards, or 635 miles of material—all going to make up a monster wire and hemp rope a little under 6 miles long. Such a rope certainly has never yet been made; and we doubt whether, excepting in Birmingham, such a one could be made. As it lies in vast coils in Messrs. Wright's machine-room, it looks like a miniature Atlantic cable, multiplied by five times the cable thickness. Of course such a rope will bear an enormous strain, and its capacity in this respect is increased by the perfection of the machinery employed in the manufacture, giving the strands an exactly uniform "lay," and imparting the regularity and the precise angle of "twist" which experience proves to possess the greatest resisting and holding strength.—*Birmingham Daily Post.*

COAL IN COLOMBIA.—Although it is thought that there is no country in South America where larger coal districts are to be found than in New Granada, now called the United States of Colombia, little or nothing has as yet been done towards turning them to account. In one or two spots, according to a report of Mr. Bunch, the British Chargé d'Affaires at Bogota, within the reach of an accessible market, and where iron is found in its immediate

neighbourhood, coal is employed to a very limited extent, but the works are carried on without system, and nowhere is machinery used. Latterly, however, the attention of the public and of the Government has been directed to immense coal fields said to have been found in the Province of Rio Hacha, near the Atlantic Coast; and, with the concurrence of Congress, steps are about to be taken to render the discovery available. Were the quality of the coal, Mr. Bunch remarks, such as it is described, its value would, from its proximity to the sea, be greatly enhanced; and the Government, to whom the mines belong, would derive no small advantage by supplying the great ocean steamers which touch at the Atlantic ports of the Republic and those of the Isthmus of Panama. The coal would also find a ready market in the West Indies. At present several lines of railway are projected (among others, one from Barranquilla, on the river Magdalena) to the sea; and the prospect of obtaining good and cheap fuel will facilitate the undertaking.

FOREIGN MINING AND METALLURGY.

The Belgian collieries present a certain amount of stagnation. Business is extremely quiet as regards coal for domestic consumption, and were it not for the exceptional requirements of metallurgical industry the depression would be complete. The coal-workers have adopted the best course which they could pursue under these circumstances—that is, they are reducing their extraction as much as possible. Notwithstanding this, a stock of coal is forming in the Basin of the Couchant de Mons, and threatens to become considerable. The Belgian siderurgical markets do not present much change. Affairs maintain a certain activity. As regards large orders for rails, they make default at present, but the rolling-mills are so well provided with work that they are not likely to wait long in vain, as new requirements may be expected to arise which will not be inferior to those which are now being supplied. Some adjudications of water conduit pipes, which have taken place at Thuin and at Brussels, have resulted in the letting of contracts at 5*l.* 9*s.* to 5*l.* 18*s.* per ton. Some castings required in connection with sewers at Brussels were let at 5*l.* 3*s.* per ton. The Monceau-sur-Sambre Blast-Furnaces Company has just concluded arrangements with the Duc de Galliera for the concession of mineral lands in the old forests of the Comte de Chambord, between St. Dizier and Vassy. These mineral bearings are to be united to the railway from St. Dizier to Vassy. The industrials of the district do not witness with much satisfaction the abstraction of its mineral wealth by foreigners. Meetings are announced as follows:—Thy-le-Château Blast-Furnaces Company, March 13, at Charleroi; Monceau-sur-Sambre Blast-Furnaces Company, March 15, at Monceau-sur-Sambre, near Charleroi; Piéton Campagne Collieries Company, March 16, at Charleroi; Grand Mambourg Sablonnière Colliery Company, March 17, at Montigny-sur-Sambre; Grands-Makets and Champs d'Oiseaux Colliery Company, March 18, at Jemeppe; Noel-Sart-Culpart Colliery Company, March 24, at Gilly; Eschweiler Mines and Foundries Company, March 24, at Blankenberg Stolberg, near Aix-la-Chapelle; Sacré-Madame Colliery Company, March 29, at Antwerp; Peronnes Colliery Company, March 30, at Brussels.

The annexed table shows the imports of pig and cast-iron into France in 1868 and 1867:—

	1868.		1867.
Introduced free of duty .....Tons	98,570	.....	54,991
Introduced for shipbuilding.....	1,471	.....	1,286
Introduced with payment of duties	16,976	.....	79,091
Total	117,017		135,368

The corresponding statistics with regard to iron and plates stand thus:—

	1868.		1867.
Introduced free of duty .....Tons	50,244	.....	61,429
Introduced for shipbuilding.....	12,694	.....	3,713
Introduced with payment of duties	1,986	.....	2,816
Total	64,924		67,958

The exports by warrants from France of pig, cast-iron, and plates amounted to 154,609 tons in 1868, against 113,701 tons in 1867. The direct exports from France of pig, castings, iron, plates, steel, &c., were 26,444 tons in 1868, against 17,880 tons in 1867. These results are considered favourable. As regards the current prospects of the French iron trade, we have no material change to notice. Meetings are announced as follows:—Loire Mines Company, March 19, at Paris; Mokta-el-Hadid Magnetic Iron Minerals Company, March 31, at Paris; and Bességes Colliery Company, April 3, at Nimes.

Some shares of the West of Mons United Collieries Company appear for the first time this year in the balance-sheet of the Belgian General Company for Promoting the National Industry. They replace those of the three companies of Belle-Vue Baisieux, Dour and Thuin, Boussu and Sainte-Croix, Sainte Claire and Longterne-Tricheres, against which they have been exchanged, in consequence of the fusion of those companies into the new one. The estimated value of the shares is taken from the average of the quotations at which the shares exchanged figured in previous balance-sheets.

Chilian copper in bars has been a little better held at Havre; 73*l.* per ton, Paris conditions, has been obtained for 20 tons. At Paris and Marseilles the price of copper has remained without material variation. On the German markets the fluctuations noticed in copper have been insignificant. The article has been rather feeble at Cologne, but at Stettin, on the other hand, the tendency of business has been somewhat better. The animation in tin, noticed last week at Havre, has further increased, and 122*l.* to 124*l.* per ton has been easily obtained for Straits and Banca. At Paris, Banca has made 128*l.*, and Straits 126*l.* per ton. The German tin markets have notably improved under the influence of the advices received from Holland and England. On the Dutch market, by reason of the smallness of the sale of tin by the Society of Commerce, the rise has made rapid progress. The Society of Commerce will offer for sale, April 1, 49,700 ingots of Banca tin, and 700 ingots of Billiton. The last price of the former week was 71½ fls. for Banca; that of the week which we are now reporting was 73½ fls., on ordinary conditions, and 80 fls. for deliveries at the end of May. Billiton, under sail, makes 73¼ fls.; disposeable makes default. It should be remarked, in justification of the increased price of tin, that until the autumn there will be no further public sales, either on account of the Society of Commerce or on account of the Government of the Dutch Indies. The ordinary comparison at the close of the month of tin in Holland presents the annexed totals, respectively, for 1869 and 1868:—Old stocks on schedules of Banca, 67,472 and 133,459 ingots; new stocks, 62,448 and 51,100 ingots: total, 129,920 and 184,559 ingots. Stocks of Billiton, 900 and 9518 ingots; Banca, en route from Java, 20,200 and 22,000 ingots; deliveries of Banca in February, 11,101 and 11,000 ingots; deliveries of the first two months of the year, 28,601 and 17,650 ingots. The stock of Billiton, under sail from Java, is estimated at 19,000 ingots. At Havre lead displays a tendency to improvement; a sale of Spanish, first fusion, was mentioned at 19*l.*, ten days or a fortnight since, but 19*l.* is now obtained easily for the same quality, while lead from other sources has made 19*l.* 4*s.* to 19*l.* 6*s.* per ton. At Paris prices have been sustained, and some transactions have been concluded at 19*l.* 4*s.* and 19*l.* 6*s.* per ton. At Marseilles lead in saumons, first fusion, has made 17*l.* 14*s.*; lead in shot, 18*l.* 18*s.*, and rolled and in pipes, 20*l.* 12*s.* per ton. At Hamburg the demand for German lead, for export, has been rather better, and prices have slightly hardened in consequence. At Rotterdam, Stolberg and Eschweiler has made 11½ fls., and German lead of various marks has brought similar rates. Zinc has shown continued firmness at Paris and Havre; 20*l.* 16*s.* has been paid for Silesian on the first market, while Silesian to be delivered at Havre has made 22*l.* At Marseilles rolled zinc has been dealt in at 30*l.* At Stettin the demand for zinc for England and Germany has assisted to harden quotations. At Hamburg the market has been firm.

GIANT BLASTING POWDER.—In the Oakes and Reese Mine, Hunter's Valley, Mariposa county, this blasting-powder, to which reference has already been made in the *Mining Journal*, has been successfully employed for some time past. The country is hard and tenacious, and the veins of quartz are narrow, varying from 10 in. to 3 ft., generally running from 1 ft. to 20 in. in width, with little or no gouge. The system which Mr. Cassel, superintendent of the mine, has introduced, and which can only be used to advantage with giant powder, is to pay the miners by the foot in depth of hole drilled; the miner doing no blasting, nor does he handle any rock, his simple duty being to drill holes where instructed. The underground superintendent or head blaster—one for each shift—instructs the miner where to drill a hole. When the hole is drilled to the depth required, the superintendent measures it and takes a memorandum of same, and sets the miner at work elsewhere. As soon as the hole is measured, the blaster loads it with from 2 to 2½ ozs. of loose powder, fills the hole with water, covers it, and leaves it until the men leave the mine at the time of shift. As soon as the men have left the mine the blaster, with his fuses, with cap or exploder attached, makes his round, and removing the cover from the hole drops the fuse into the hole, works the exploder into the powder, which is quite soft, fires the fuse, and in a few minutes will explode all the holes drilled during the working shift. As soon as the explosions are made, the rockmen and skipmen clear away the debris which may be in the way of clearing new holes, and when the men again come into the mine there is work for them ahead in drilling. A blast is only fired when the men are at work in the mine when it becomes necessary to remove material. It appears that, in comparison with ordinary gunpowder, nearly twice the amount of work can be performed in a given space; the consumption of steel, hammers, and candles is about one-half; the width of the drifts is only one-half, so that less material has to be removed and hoisted from the mine. The miner never incurs any danger from the use of the powder, and it does not appear to cause additional sickness or disease. So far as the miner is concerned, he can earn more money in using the ¾-inch steel and small hammer than in any other way. It is true he must earn his money, and is not paid by the day. One thing is certain, that with the giant powder and the use of small steel and hammers the miner must earn his money, and cannot shirk his work, as is too often the case under the old system of mining.

CURIOUS PRODUCTION OF COLD.—Dr. Phipson has recently discovered that an intense degree of cold is produced by dissolving sulphocyanate of ammonium in water. Many salts, more especially salts of ammonia, lower the temperature of water whilst dissolving; but, according to Dr. Phipson, no compound produces this effect in so marvellous a manner as sulphocyanate of ammonium. In one experiment 35 grammes of this salt, dissolved rapidly in 35 cubic centimetres of water at 23° centigrade, caused the thermometer to descend in a few seconds to 10° c. The moisture of the atmosphere instantly condensed itself on the outside of the glass in thin plates of ice.—*Scientific Review.*

THE INUNDATED SALT MINES.—In consequence of the inundations of the salt mines of Wieliczka the Austrian Government had charged a committee of seven of the principal engineers to institute an enquiry on the subject. These functionaries have now sent in a report to the effect that the irruption of water is not of a nature to destroy the mines or prevent their working; and that the forcing pumps for emptying the pit are now nearly all set up. [A full description of "the Great Polish Salt Mines—their Wonders and their Wealth," appeared in the *Mining Journal* of Dec. 19 last.]

FOREIGN MINES.

ST. JOHN DEL REY.—The directors have received the following report, dated Morro Velho January 29:—Morro Velho produce, second division of January, 11 days, 3284 oitavas; yield 1·687 oits. per ton. Gaia produce for the above period, 489 oits.; yield, 1·552 oits. per ton. Although the general standard yield is not quite so high as was obtained in the first division of the month, yet the produce is larger for the same period by above 200 oits.; the stamps have done larger duty, and the gold return is better. There is reason to conclude this rate of produce may be maintained for the present, and that the cost in extracting it will now be somewhat lessened. Remittance received, 20,640 oits.= 198·288 lbs. troy.

DON PEDRO.—Mr. F. S. Symons reports—Produce weighed to date, 17,781 oits.; estimate for January, 19,500 oits. Remittance, 40,059 oits. This is the largest remittance sent during 1868. Operations are progressing steadily and successfully, good duty done at Treloar's level, and progress made in deep adit, where ground is more favourable than in commencement of month. General stopes continue to yield well, and box work has been taken out from a line in curve more southerly than any we have yet encountered; it is near water level, so we shall be unable to follow it far. Finding such rich deposits at our deepest point speaks volumes as to our future prospects.

ANGLO-BRAZILIAN.—Mr. F. S. Symons reports—Produce cleaned to Jan. 20 amounted to 1070 oits. Remittance 5797 oits. The attendance of force has been fair, and the features of the mine present little or no alteration. At the stopes from Dawson's shaft the lode is still small, and much disordered by killas. Operations have been again commenced at the Buraco seam, and favourable indications are manifesting themselves. The lodes of Dawson's south, and west and east of Foster's, are of large proportions, and in appearance most promising, but at present are yielding much under their average. Similar fluctuations have before occurred in this mine. Dawson's, Haymen's, and Foster's shafts are being pushed on with all speed.

ROSSA GRANDE.—Mr. Hilcke reports—Remittance 1961 oitavas. Force, I am pleased to say, has come in more freely, and during the last fortnight our operations underground have proceeded more speedily, but at surface the unfavourable weather is hindering us considerably. I have nothing of great importance to communicate regarding the mine; the lode in depth and at the eastern extremity is becoming very variable, that in the 50 west is again improving, whereas the lode in the 40 fm. level east is becoming very small. All these changes, however, are of no duration, and therefore of little note. This mine, which is known here as Mina de Serra, will be called so in future. At the Bahu Mine and Mina Alto we have resumed operations, but the progress at both places is greatly impeded by the heavy rains. Our main force at Gongo Mine has been set to work exploring the western part of same, and commencement has been made here for sinking a shaft.

SAO VICENTE.—The directors have the following advices from their superintendent in Brazil, dated Feb. 1:—Jacotinga Formation: The cross-cut, No. 2, driven through the jacotinga, is now being carefully re-sampled from its entrance to the present end, and in order to do so effectually everything in use is new. Everything that had been previously used in cleaning or extracting gold elsewhere has been discarded. A great portion of the cross-cut has already been sampled, according to the directions given by Capt. Treloar, and as no gold has yet been found I am beginning to fear that the few particles seen some time since in the samples came from the utensils which had been in use at Sao Vicente. After we have completed the sampling, which will be in the course of a few days, we shall extend the cross-cut and open out east and west upon the jacotinga, in accordance with Capt. Treloar's request.—Rock Formation: We have recommenced sinking on the lode at Phillips's shaft, in the eastern section. The lode is very small, but as we are only a few feet below the back of it, to form an opinion at present would be premature.

TAQUARIL.—Dr. Birt (under date Jan. 28) writes—All the works in hand have been pushed on with vigour, and the fine weather in January has been taken advantage of. Mr. W. H. Richards writes—I have visited the establishment with Dr. Birt, and must express my great and agreeable surprise at the progress that has been made in the mining operations and surface works in so short a time, and at such a moderate cost, and it cannot but be gratifying to Dr. Birt to find that he has been so ably seconded by Captain Pengilly and Mr. Rouse in carrying out so economically the preliminary arrangements for the future working of the mine. Since my arrival I have been visited by many of my old "Minas" friends, who are unanimous in their opinions that the Taquaril Mine will prove one of the richest in Minas Geraes. Capt. Pengilly's report, dated Jan. 23 states that the sett is very large, being upwards of six miles in length, and of a great width, embracing several large gold-bearing lodes, auriferous throughout, which run east and west longitudinal with the sett, and on the ridge of a very elevated mountain, where the lodes can be seen cropping out for miles in length;-a more transcendent advantage for mining operations cannot be met with. In the bottom of the old mine there is no symptoms of the lodes declining in strength, and there are favourable indications for deep works. The mine is now only down to about 40 fms. from surface, and the deep adit, which is now in vigorous operation, will communicate with the new engine-shaft, which is also going on with great rapidity, at a depth of 60 fms., or 20 fms. below the bottom of the old workings, when upwards of 35 fms. of backs will be laid open for excavation. The lodes are favourable for quartzing, and a great deal of lode stuff can easily be extracted from the mine by a small force, sufficient to supply 70 to 80 head of stamps, each head stamping 3½ tons per 24 hours, producing at least 3 oits. of gold per ton taken indiscriminately from the shoot as broken under the miner's pick, but when the rich vein of sheet gold makes its appearance the lode or shoots round about the vein are also rich, when the stamps will then yield 5, 10, 15, and very often 20 oits. per ton, never fall in making a satisfactory average from year's end to year's end. In 1837 and 1838 I was employed at this establishment as a miner until the latter end of the last date above mentioned: on the closing up of the concern, when I left, a magnificent vein of gold was going down in the bottom of the 40 near the bottom of the old engine-shaft, that could not be taken out in consequence of the water overpowering the little horse-engine, which was only about 6-horse power. This vein of gold will again be seen as soon as the water is in fork, and in a short time from the date of this letter. The new engine-shaft is now down 29 fathoms from surface, only 11 fms. to sink to reach the 40 or the bottom of the old mine, where gold of the most perfect purity and lustrous yellowness will be met with. I have from time thoroughly examined the beds or layers of the company's property, and find the extensive range of clay-slate in this very prolific gold mining district, and round about, is not liable to be undermined by any unfavourable rock. At the bottom of a shaft only 8 fms. deep from surface, which was sunk by us in October last to intersect the upper part of the shoot left by the ancient proprietors, thought to be worthless, where good samples of gold have been taken by me from the lode, which is 10 ft. wide, and of pretty near the same composition as that of the lode in the bottom of the mine, but not so metalliferous, notwithstanding the samples washed in bateas, which have been taken at intervals, I estimate when stamped will produce 14 to 18 oits. of gold per ton. At this place, it appears, upwards of 40 years ago the old people had taken away some of the rich veins, but, as I have stated before, the lode standing round about these veins are also rich; we have several hundreds of tons of this stuff at surface waiting for the stamps, which will be got ready without delay. Taking into consideration the various features of this mine, its present appearance, resources, and future prospects, I conclude in stating that the Taquaril, with good engineering, will prove beyond an ordinary speculation, and no doubt the best paying mine in this country. The head mining agent should be well acquainted with jacotinga formations, and have had great practice in scrutinising longitude, and cross-veins in mines like this (a hard rock mine captain will be of no use here), such as St. John del Rey, and other mines of that description. The Taquaril is already opened out in such a position that any experienced man, well acquainted with jacotinga mines, cannot fail in reaching gold without delay. Water and wood plenty.—The Ponte Grande: The gold-bearing lodes at the Ponte Grande are three in number, but not running parallel with the lodes of the Taquaril, but a few degrees south of west and north of east, which can be seen at the surface for a great length; this mine is well worthy of trial; the lode looks well; it has already been worked many years ago by Sigs. Vazes, the late proprietors of the Taquaril and the Ponte Grande Mines, but on a very small scale, only a little open cutting about 24 ft. high. Here a deep adit may be driven from the high-water mark on the bed of the great river to intersect the lodes at a great depth, where stoping ground can be easily made on the lode sufficient to supply any number of stamp-heads that may be required. Water power plenty.

ANGLO-ITALIAN GOLD.—Mr. Pearson Morrison reports that the winze in the gallery Friza has now a depth of 15 metres. This will be continued down to the 20 metre level, from which point ends will be driven north and south. These, when sufficiently advanced (say, in the next two months), will give a large field for stoping, at the same time considerably reduce the cost per ton of mineral raised. The supply of mineral from the above places has somewhat decreased, though more intermixed with the matrix, owing to the friable character of the ore, yet giving a fair yield per fathom. Some 37 metres north from said winze another, named Friza winze No. 2, has been commenced on the continuation of the Friza lode, and I have every reason to believe will prove equally as productive as the other. Also two other galleries, named Friza Nos. 2 and 3, have been commenced this month, distant from one another some 150 metres. These additional two, in connection with the old gallery Friza, Boscon d'Oro, and Santa Barbara, will effectually prove the entire length of the Friza lode over 650 fms. We have at last succeeded in effecting a drainage of old workings on the Toni lode, and commenced squaring an old winze, at the bottom of which the lode is intact, though abandoned by the old adventurers on account of the great influx of water. It is in this place that the richest ore has been raised, yielding from 1½ to 3 ozs. of gold per ton. We are also enabled to continue the clearing out of an old level driven north on Toni lode from winze, leaving ample space for other explorations further northwards. The assay-furnaces are finished, also the dormitories and office. The buildings for spalling sheds, &c., all in a forward state; the cold weather now having passed, the mills will be again at work in a few days. The sledge-road is near completion, connecting the various galleries with the reduction works, and effecting a saving in transport of 4½ frs. per ton.

LUSITANIAN.—March 2: In sinking Taylor's engine-shaft below the 120 the lode is worth 1½ ton of ore per fm. In sinking River shaft below the 100 the lode is 2 ft. wide, composed of flookan.—Levels on Basto's Lode: In the 120, east of Taylor's, the lode is worth 3 tons per fathom. In the 120 fathom level west the lode is 2½ ft. wide, worth 1½ ton per fm. In the 110 east the lode is 2 ft. wide, composed of loose spar for 1½ ft. wide, and to the south there is a piece of the lode 1 ft. wide, composed of hard spar, mixed with ore, worth 1 ton per fm. In the 110 west the lode is 1 ft. wide, composed of quartz and stones of ore. In the 90, east of River shaft, the lode is 1½ ft. wide, composed of flookan. In the 70, east of ditto, the lode is 1½ ft. wide, composed of flookan and quartz. In the 38, west of Peres' shaft, the lode is 9 in. wide, composed of flookan and quartz, with stones of ore, and letting out small streams of water.—Levels on Branch: In the 18, west of Peres' shaft, the lode is 1½ ft. wide, composed of quartz and country, with copper ore, worth ½ ton per fathom. In the 8 fm. level west the lode is 9 in. wide, worth ¾ ton per fathom. In the adit level, west of ditto, the lode is 1 ft. wide, worth ¾ ton per fm.—Levels on Ponte Lode: In the 28, east of Slide lode, the lode is 8 in. wide, composed of quartz, spotted with mundic, from which there is flowing small streams of water.—Cross-Cuts: In the 60 cross-cut, north of River shaft, the ground is a hard gneiss. In the 28 fathom level cross-cut, south of Basto's lode, west of Peres' shaft, the ground is a hard gneiss, with a little water oozing through it.—Carvalhal: In sinking the incline shaft below the 40 the ground at the shaft is rather improved, but we have no lode to value.—Levels on the Great Lode: In the 40, east of incline shaft, the lode is 3 ft. wide, composed of quartz and lead, worth ½ ton per fm. In the 30, east of ditto, the lode is worth 2 tons per fathom for lead and blende together. In the 20 east the lode is worth ½ ton of lead per fathom. In the 10 east the lode is worth 1 ton of lead per fathom.—Levels on Caunter Lode: In the adit level, west of incline shaft, the lode is 15 in. wide, composed of quartz and lead; for the latter worth ½ ton per fm. The lode in the 10, west of ditto, is split into branches, composed of quartz and spots of lead.—Levels on North Lode: In the deep adit level, west of the River Caima, the ode is from 2½ to 3 ft. wide, composed of white killas and flookan.

PESTARENA UNITED.—T. Roberts, J. Mitchell, J. Roberts, T. Warne, March 2: Piedimulera: We remit this day to the office five ingots of gold, weighing 398 ozs. 10 dwts. 21 grs., obtained in the month of February from 578 tons of ore; 55 tons, amalgamated at Pestarena, yielded 64 ozs.; and 118 tons of inferior ore from Pestarena, amalgamated at Battigio, yielded 104 ozs. 3 dwts. 16 grs., and 17 tons of ore from the Cani Mine, amalgamated at Battigio, yielded 9 ozs. 1 dwt. 18 grs.; and 388 tons of ore from Val Toppa Mine, amalgamated at Piedimulera, yielded 221 ozs. 5 dwts. 11 grs.—Val Toppa Mine: We have communicated the rise from the back of Marmo Rosso level to the level above, ventilating the backs on Marmo Rosso lode, and also the end driving south; the lode in this end is not so wide as when last reported on, but the quality of the ore is better. A trial made with the small mills show it to be worth ½ oz. of gold per ton, and the lode in the end driving north at Marmo Rosso is yielding 4 ozs. of gold per fathom. At No. 2, or Fisher's, level the new lode in the end, driving south from inside, or first, cross-cut, is poor at present. The flat lode, in the end driving north, is 1½ ft. wide, and the width of the new lode, in the end driving north, is at present 4 feet. We shall commence a new stope in the back of this level this month. The new, or flat, lode, in the end driving south from the second cross-cut, is 5 ft. wide; and the lode in the end, driving north from this cross-cut, is 4 ft. wide, a most splendid lode. We have not made any separate trial of it lately, but have no doubt but what it will give 2 ozs. of gold per ton. We are doing a little stoping on the flat lode in the side of this level. In the new cross-cut, driving east to reach the flat, or new, lode, the men have made good progress during the past month. We expect to reach this lode by the end of the month. For the last 5 metres driving the ground has been of a very favourable nature, carrying branches of pyrites. We have made some trials of the whole rock, and find it to contain a small quantity of gold. There is no doubt but what the lode will be found rich when reached in this stratum. During the past month we recommenced driving the end of No. 3 level south; the lode has widened out very much. It gave by a trial some gold, but not to value as yet, but bids fair for a speedy improvement. The cross-cut east, in this level, is much the same as last reported—crossing branches of quartz, and letting out water. In the cross-cut west, in No. 4 level, there is no change. We have suspended for the present the cross-cut east, and the men are now driving north on the lode cut.

Aquavite: The lode in the 46 fm. level end south yields 4 ozs. of gold per fathom. The 33 fm. level end south apparently has got through the bar of hard ground, and is more favourable for driving. The stopes in the back of this level are producing 7 ozs. of gold per fathom. The lode in the 23 fm. level end south yields 2 ozs. of gold per fathom, and the stopes in back 5 ozs. per fathom. The lode in the end, driving north from the bottom of the winze under this level, yields 6 ozs. of gold per fathom. The stope in the bottom, south of whim-shaft, is worth 5 ozs. per fathom, and the stope in the bottom of this level, north of engine-shaft, yields 4 ozs. per fathom. The boundary stopes in the bottom of the adit are now producing 4 ozs. of gold per fathom. We have commenced to drive an intermediate level about 8 fathoms under the deep adit to drive south from Aquavite whim-shaft: we expect this end will reach the line of ore now worked on in the 23 and 33 in about 3 or 4 fms. driving; since we have started this end the lode has already improved.—Peschiera: The stopes in the bottom of the 75 yields fully 6 ozs. of gold per fathom, and the stopes in the bottom of the 70 are a little improved. At the 46 the stopes and ends driving are yielding on an average 3 ozs. of gold per fathom.—Battigio: We have suspended the stopes in the back of Cavetta level, and have commenced to stope on the Cadorna lode in the Piazza Nuovo level. The unchangeable weather made very much against us in the past month at Pestarena, not having sufficient water to work more than 74 to 80 small mills per day, and we were not able to dress all the ore raised, neither were we able to bring but a portion of the ore raised at the Cani Mine to the establishment. We increased our surface hands yesterday to do the necessary repairs on damages done by the floods, and at Pestarena to blast up some other large rocks in the Anza, to turn the force of the river (in time of floods) further from the eastern bank; we shall also during this week recommence the river wall, and increase the force on the excavations for the new road from the Aquavite adit leading to Peschiera, where we intend to make the new dressing-floors at Battigio; to repair the damages done to the dam in the Anza; and also at Piedimulera to repair the water-course against the river, and other stonework as protection against another flood. The water in the Anza being low at present, it is the most favourable time to do this work.

VAL ANTIGORIA.—Thomas Roberts, Feb. 27: By way of exploring we have discovered, in the western side of the Alfonzo, an old cross-cut, the entrance of which is about 89 metres north of the main shaft, and 18 metres west. In clearing out this cross-cut we reached, in 11 metres, a lode that has the appearance of No. 2; 7½ metres inside the supposed No. 2 we find the cross-cut has gone through another small lode, but not to value at this point. The end of the cross-cut is 4 metres inside the last-mentioned lode, making together 40 metres explored in this western ground. The first-mentioned lode reached in this cross-cut is unproductive where the cross-cut went through it. A level has been driven south on it 15 metres. There is also a level on it north at present full of stuff, apparently an old stull broken down, and where very likely some ore had been extracted. We have cleared about 6 metres of this level, and have found a winze full of water. By sounding we find it 11 metres deep; 20 metres ahead of this winze we may expect an intersection of the slide, on which the first part of the cross-cut is driven to the last small lode cut in the cross-cut; 210 metres north from this old working, and about 40 metres higher, we find, on the western side of the Alfonzo, an old level driven on No. 2 lode about 37 metres, and a cross-cut has been driven west from it about 37 metres; this cross-cut has passed some branches and a lode about where No. 4 lode might be expected. The end of this cross-cut is full of stuff; we are now clearing it out to reach the junction of the rocks, which I shall speak of below. About 120 metres north from this cross-cut, and about 30 metres higher up on the eastern side of the Alfonzo, we have cleared out an old cross-cut 21 metres, driven, to all appearance, to reach the No. 1 lode; it has passed two small fissures. The end of this cross-cut is near where No. 1 lode might be expected. I cannot say the fissures cut is the lode. The entrance of this cross-cut was not visible before the flood; yet, further north, the flood brought in sight, by the lowering of the bed of the Alfonzo, apparently the junction of the mica-slate, the gneiss rock that bounds it on the west, where we see it on the side of the torrent. It is at this point too much broken up. We purpose to clear and drive the second cross-cut west, with a view to reach the junction, and into the rock that bounds it on the west, where very likely we shall meet with the great mineral channel of Crodo. We have done some sheding in the western ground, with the same view—to find this junction, but the sand and the unsettled mountain is too deep to accomplish much. We have not as yet done any sheding on the high ground north from the mine, on the eastern side of the Alfonzo. South from No. 2 mine we are also sheding, trying for the back of the lodes, but found no rock as yet.—Underground: The lode in the winze sinking under the 20, on No. 2 lode, is small, but yielding some good ore. During next month this winze will be down for a 30 fm. level, when by driving south we expect to reach the same run of ore that the winze went through above. The 20 end north, on this lode, is looking promising. No change in the adit end north on No. 1 lode. We have commenced a new stope on this lode, in back of the 20 south; it yields 2 tons of ore per fm. Since we smelted last we have amalgamated 32 tons of ore; the same produced 1734 grammes of amalgam, equal, if smelted, to about 15 ozs. of gold.

PONTGIBAUD.—W. H. Rickard, March 1: Roure Mine: The 140 metre level, south of Richards's shaft, is in a soft, disordered lode, composed of flookan and spots of barytes. The same level, south of winze, is in a lode composed of red jointy quartz—unproductive. The 80 south is in a strong lode, letting out much water, but producing no ore to save. The 60 south has been suspended, to hole the rise behind the end, which being now completed the driving will be resumed; the lode yields ½ ton per fathom. The winze below the 40, being holed to the 60, has opened a good piece of ground, worth from ¾ to 1½ ton per fathom. The 20 cross-cut east has cut several small branches containing ore. We expect to cut Virginie's lode in a few metres more driving. The stollen south has entered a strong-looking lode, composed chiefly of quartz, containing stones of lead ore. The stollen cross-cut, west of Virginie's, is without change.—La Grange: The 100 cross-cut, east of Nosky's shaft, has cut the wall of the lode, of which something will be seen in a day or two. The 80 metre level north yields stones of ore. The winze sinking in this level yields ½ ton of ore per fm. The 60 north is suspended for a while; the lode is hard, containing stones of ore. The 20 north is in soft, unproductive ground. The adit south is poor.—Mioche: The adit level north, on No. 6 lode, is in speedy ground, but still unproductive. The cross-cut east has met with no change.—Bonzarat: We have suspended the cross-cut east of the shaft, and are now bringing up an adit to take away the water, which is much increased, when we shall cross-cut westward.—La Brousse: The 100 metre level south has met with ore, which seems to be dipping fast before the end; the back of the end yields 1 ton of ore per fathom. We have set to drive on the western part of the lode in this level, which is unproductive. The 80 south is in soft ground, yielding no ore to value. The 60 south yields a little mundic, but no lead ore. The winze below this level, on the eastern part, yields 5 tons per fm. The 40 north and south are poor, as also is the 20 south. We have made a communication with the surface shaft in the last-named level, which gives us good air. The 20 ends, north and south of Whine shaft, on the western lode, yield mundic, mixed with quartz and gossan.—Pranal: The 70 cross-cut has again become harder. The 50 metre level, north of junction, yields ½ ton of ore per fm. The rise in the same level south yields a little saving work. The 50, north of cross-cut, is much improved, yielding 1 ton of ore per fathom: The same level south is unproductive. The 30 north yields ¾ ton per fathom. The same level south is poor. The 8 ends, north and south, yield ½ ton per fm. each. The 8, north of cross-cut, is poor. The same level south yields a little saving work. The winze below the 8 proceeds pretty well; the lode is poor. The adit, south of Bontoux's shaft, remains the same in appearance. Our stopes and tribute pitches throughout all the mines maintain about their usual yield. Our samplings for the past month have amounted to 299 tons.

[For remainder of Foreign Mines, see this day's Journal.]

THE MANUFACTURE OF WATCHES AND CLOCKS.—A most interesting and instructive little work, describing briefly, but with great clearness, the rise and progress of watch and clock making, has just been published by Mr. J. W. Benson, of 25, Old Bond-street, 99, Westbourne-grove, and the City Steam Factory, 58 and 60, Ludgate-hill. The book, which is profusely illustrated, gives a full description of the various kinds of watches and clocks, with their prices, and no one should make a purchase without visiting the above establishments or consulting this truly valuable work. By its aid persons residing in any part of the United Kingdom, India, or the Colonies, are enabled to select for themselves the watch best adapted for their use, and have it sent to them with perfect safety. Mr. Benson, who holds the appointment to the Prince of Wales, sends this pamphlet to any address on receipt of two postage stamps, and we cannot too strongly recommend it to the notice of the intending purchaser.

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